

# Dell Precision™ T7400 User's Guide

[Buy T7400 Memory](#)

Model DCDO

[www.dell.com](http://www.dell.com) | [support.dell.com](http://support.dell.com)

**Notes, Notices, and Cautions**



**NOTE:** A NOTE indicates important information that helps you make better use of your computer.



**NOTICE:** A NOTICE indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.



**CAUTION:** A CAUTION indicates a potential for property damage, personal injury, or death.

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Model DCDO

August 2007 P/N YT583 Rev. A00

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# 1

## Finding Information



**NOTE:** Some features or media may be optional and may not ship with your computer. Some features or media may not be available in certain countries.



**NOTE:** Additional information may ship with your computer.

**What Are You Looking For?**

- A diagnostic program for my computer
- Drivers for my computer
- Desktop System Software (DSS) **Drivers and Utilities Disc**

Documentation and drivers are already installed on your computer. You can use the *Drivers and Utilities* disc to reinstall drivers (see "Reinstalling Drivers and Utilities" on page 130), or to run the Dell Diagnostics (see "Dell Diagnostics" on page 123).

Documentation and drivers are already installed on your computer. You can use the *Drivers and Utilities* disc to reinstall drivers or to access your documentation.

Readme files may be included on your *Drivers and Utilities* disc to provide lastminute updates about technical changes to your computer or advanced technicalreference material for technicians or experienced users.

**Find It Here**



**NOTE:** Drivers and documentation updates can be found at [support.dell.com](http://support.dell.com).

- How to set up my computer
- How to care for my computer
- Basic troubleshooting information
- How to run the Dell Diagnostics
- How to set up a printer
- How to open my computer

**Quick Reference Guide**

**NOTE:** This document may be optional and may not ship with your computer.



- Warranty information
- Terms and Conditions (U.S. only)
- Safety instructions
- Regulatory information
- Ergonomics information
- End User License Agreement

**NOTE:** This document is available as a PDF at [support.dell.com](http://support.dell.com).

### Dell™ Product Information Guide



#### What Are You Looking For?

- Service Tag and Express Service Code

#### Find It Here

- Microsoft Windows License LabelService Tag and Microsoft® Windows® License

These labels are located on your computer.

- Use the Service Tag to identify your computer when you use **support.dell.com** or contact support.
- Enter the Express Service Code to direct your call when contacting support.



**NOTE:** As an increased security measure, the newly designed Microsoft Windows license label incorporates a

missing portion or "hole" to discourage removal of the label.

- Solutions — Troubleshooting hints and tips, articles from technicians, and online courses, frequently asked questions
- Community — Online discussion with other Dell customers
- Upgrades — Upgrade information for components, such as memory, the hard drive, and the operating system
- Customer Care — Contact information, service call and order status, warranty, and repair information
- Service and support — Service call status and support history, service contract, online discussions with technical support
- Dell Technical Update Service —

- Proactive e-mail notification of software and hardware updates for your computer
- Reference — Computer documentation, details on my computer configuration, product specifications, and white papers
- Desktop System Software (DSS) — If you reinstall the operating system for your computer, you should also reinstall the DSS utility. DSS provides critical updates for your operating system and support for processors, optical drives, USB devices, and so on. DSS is necessary for correct operation of your Dell computer. The software automatically detects your computer and operating system and installs the updates appropriate for your configuration.

- Downloads — Certified drivers, patches, and software updates

**Dell Support Website — [support.dell.com](http://support.dell.com)**

**NOTE:** Select your region or business segment to view the appropriate support site.

To download Desktop System Software:

- 1** Go to **support.dell.com**, select your region or business segment, and enter your Service Tag.
- 2** Select **Drivers & Downloads** and click **Go**.
- 3** Click your operating system and search for the keyword *Desktop System Software*.


**NOTE:** The support.dell.com user interface may vary depending on your selections.



**What Are You Looking For?**

- How to use Microsoft Windows Vista™
- How to work with programs and files
- How to personalize my desktop **Windows Help and Support**
- How to reinstall my operating system

**Find It Here**

- 1 Click the Windows Vista Start button ,  and then click **Help and Support**.
- 2 In *Search Help*, type a word or phrase

that describes your problem, and then press <Enter> or click the magnifying glass.

3 Click the topic that describes your problem.

4 Follow the instructions on the screen.

**Operating System Disc**

**NOTE:** The *Operating System* disc may be optional and may not ship with your computer.

The operating system is already installed on your computer. To reinstall your operating system, use the *Operating System* disc (see "Reinstalling Windows XP or Windows Vista" on page 137).



After you reinstall your operating system, use the *Drivers and Utilities* disc to reinstall drivers for the devices that came with your computer.

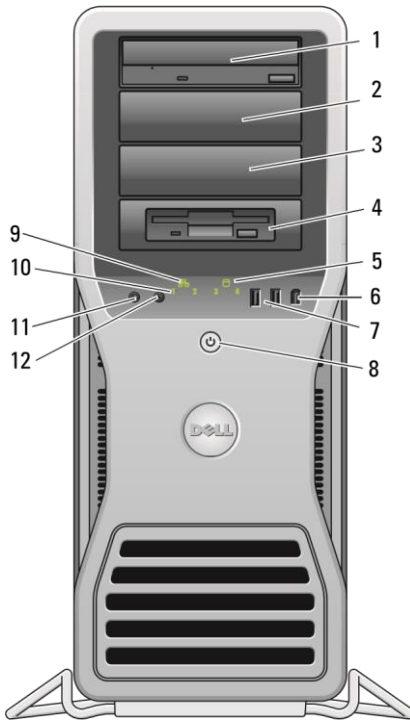
Your operating system product key label is located on your computer.


**NOTE:** The color of your disc varies based on the operating system you ordered.

- How to use Linux **Dell Supported Linux Sites**
- E-mail discussions with users of Dell Precision™ products and the Linux operating system
  - Linux.dell.com
  - Lists.us.dell.com/mailman/listinfo/linux-precision
- Additional information regarding Linux and my Dell Precision computer

# 2 About Your Computer

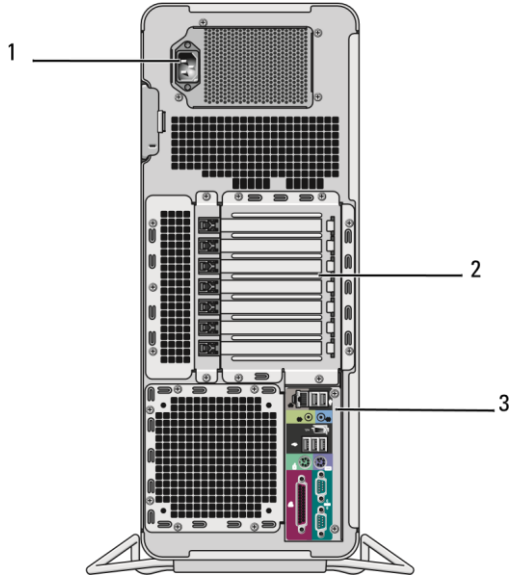
## Front View of the Computer



- 1-3 5.25-inch drive bays Can hold an optical drive, Media Card Reader, floppy drive, or SATA hard drive in a 5.25-inch drive bay carrier. The hard-drive carrier is only for use in the 5.25-inch drive bays. The floppy drive/Media Card Reader and hard drive carriers are not interchangeable.
  - 4 5.25-inch drive bay with special 3.5-inch drive panel plate Can hold an optical drive, Media Card Reader, floppy drive, or SATA hard drive in a 5.25-inch drive bay carrier. The drivepanel plate shown here is only for use with a floppy drive or Media Card Reader; it can be installed in front of any of the four 5.25-inch drive bays. For more information, see "Drive Panels" on page 246. The hard-drive carrier is only for use in the 5.25-inch drive bays. The floppy drive/Media Card Reader and hard drive carriers are not interchangeable.
  - 5 hard-drive activity light The hard drive light is on when the computer reads data from or writes data to the hard drive. The light might also be on when a device, such as your optical drive, is operating.
  - 6 IEEE 1394 connector Use the IEEE 1394 connector for high-speed data devices such as digital video cameras and external storage devices.
  - 7 USB 2.0 connectors (2) Use the front USB connectors for devices that you connect occasionally, such as flash memory keys, cameras, or bootable USB devices. It is recommended that you use the back USB connectors for devices that typically remain connected, such as printers and keyboards.
  - 8 power button, power light Press the power button to turn on the computer. The light in the center of this button indicates power state. See "Controls and Lights" on page 32 for more information.
-  **NOTICE:** To avoid losing data, do not use the power button to turn off the computer. Instead, perform an operating system shutdown.
- 9 network link light The network link light is on when a good connection exists between a 10-Mbps, 100-Mbps, or 1000-Mbps (or 1-Gbps) network and the computer.
  - 10 diagnostic lights (4) Use these lights to help you troubleshoot a computer problem based on the diagnostic code. For more information, see "Diagnostic Lights" on page 105.

- 11 microphone connector      Use the microphone connector to attach a personal computer microphone for voice or musical input into a sound or telephony program.
- 12 headphone connector      Use the headphone connector to attach headphones.

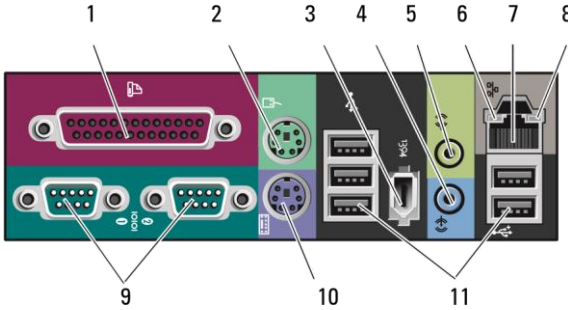
## Back View of the Computer



- 1 power connector      Insert the power cable.
- 2 card slots      Slots 2-6 support full-length cards. This includes one PCI, two PCI Express 2.0 x16, and two PCI-X slots. Slots 1 and 7 support half-length cards. This includes one PCI Express x8 (wired as x4) and one PCI-X slot.
- 3 back panel connectors      Plug USB, audio, and other devices into the appropriate connector (see "Back Panel Connectors" on page 24 for more information).

**⚠ CAUTION:** Ensure that none of the system air vents are blocked. Blocking them would cause serious thermal problems.

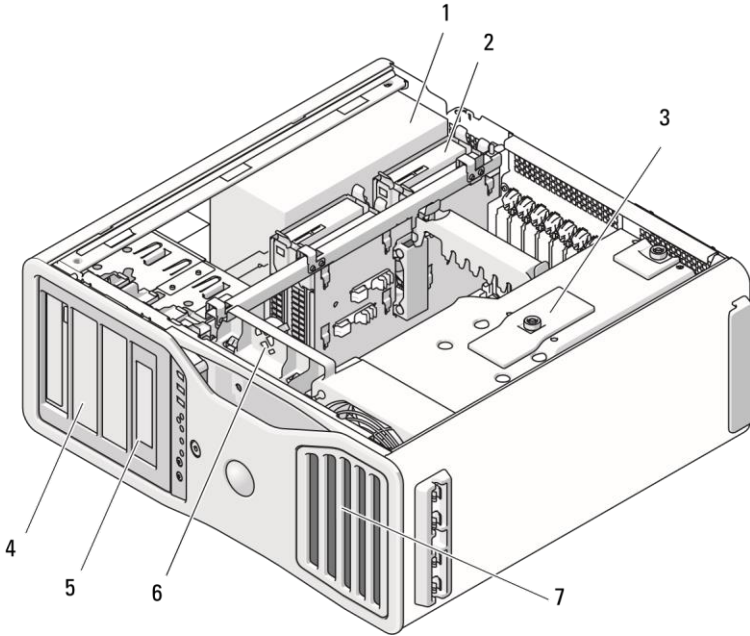
# Back Panel Connectors



- 1 parallel connector Connect a parallel device, such as a printer, to the parallel connector. If you have a USB printer, plug it into a USB connector.  
**NOTE:** The integrated parallel connector is automatically disabled if the computer detects an installed card containing a parallel connector configured to the same address. For more information, see "System Setup Options" on page 75.
- 2 mouse connector Plug a standard PS/2 mouse into the green mouse connector. Turn off the computer and any attached devices before you connect a mouse to the computer. If you have a USB mouse, plug it into a USB connector.
- 3 IEEE 1394 connector Use the IEEE 1394 connector for high-speed data devices such as digital video cameras and external storage devices.
- 4 line-in connector Use the blue line-in connector to attach a playback device such as an MP3 player, CD drive, or VCR. On computers with a sound card, use the connector on the card.
- 5 line-out connector Use the green line-out connector to attach most speakers with integrated amplifiers. On computers with a sound card, use the connector on the card.

- |    |                           |   |
|----|---------------------------|---|
| 6  | link integrity light      | <p>Green — A good connection exists between a 10-Mbps network and the computer</p> <p>Orange — A good connection exists between a 100-Mbps network and the computer</p> <p>Yellow — A good connection exists between a 1000-Mbps (or 1-Gbps) network and the computer</p> <p>Off — The computer is not detecting a physical connection to the network</p>   |
| 7  | network adapter connector | <p>To attach your computer to a network or broadband device, connect one end of a network cable to either a network jack or your network or broadband device. Connect the other end of the network cable to the network adapter connector on your computer. A click indicates that the network cable has been securely attached.</p> <p>Do not plug a telephone cable into the network connector. On computers with an additional network connector card, use the connectors on the card and on the back of the computer when setting up multiple network connections (such as a separate intra- and extranet). It is recommended that you use Category 5 wiring and connectors for your network. If you must use Category 3 wiring, force the network speed to 10 Mbps to ensure reliable operation.</p> |
| 8  | network activity light    | Flashes a yellow light when the computer is transmitting or receiving network data. A high volume of network traffic may make this light appear to be in a steady "on" state.   |
| 9  | serial connectors (2)     | Connect a serial device, such as a handheld device, to the serial port. If necessary, the address for this port can be modified through system setup (see "System Setup" on page 75).   |
| 10 | keyboard connector        | If you have a standard PS/2 keyboard, plug it into the purple keyboard connector. If you have a USB keyboard, plug it into a USB connector.   |
| 11 | USB 2.0 connectors (5)    | <p>It is recommended that you use the front USB connectors for devices that you connect occasionally, such as flash memory keys, cameras, or bootable USB devices.</p> <p>Use the back USB connectors for devices that typically remain connected, such as printers and keyboards.</p>  |

# Inside View



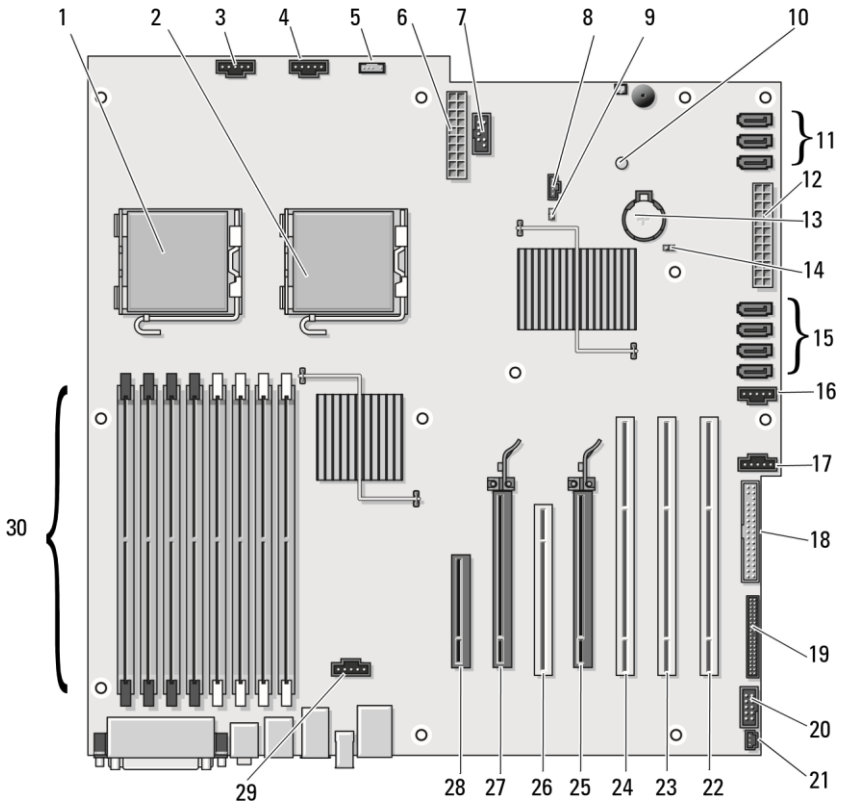
- 1 power supply
- 2 hard drive bay
- 3 memory shroud



**NOTICE:** The memory shroud holds the (optional) memory riser cards in place; its thumbscrews must be sufficiently tight in order to secure the risers and to avoid damage.

- 4 5.25-inch drive bay
- 5 5.25-inch drive bay with 3.5-inch drive panel plate
- 6 card fan 7 front fan

# System Board Components



- |   |                                       |    |                                     |
|---|---------------------------------------|----|-------------------------------------|
| 1 | primary processor connector (CPU_0)   | 16 | hard drive fan (FAN_HDD)            |
| 2 | secondary processor connector (CPU_1) | 17 | secondary hard drive fan (FAN_HDD2) |
| 3 | front fan connector (FAN_FRONT)       | 18 | floppy drive (DSKT)                 |
| 4 | card cage fan (FAN_CCAG)              | 19 | front panel connector (FRONTPANEL)  |
| 5 | internal speaker connector (INT_SPKR) | 20 | front panel 1394 connector (FP1394) |
| 6 | power connector (POWER2)              | 21 | chassis intrusion header (INTRUDER) |
| 7 | USB (INT_USB)                         | 22 | PCI-X card slot (SLOT7_PCIX)        |



8	auxiliary hard drive LED (AUX_LED)	23	PCI-X card slot (SLOT6_PCIX)
9	password jumper (PSWD)	24	PCI-X card slot (SLOT5_PCIX)
10	auxiliary power LED (AUX_PWR)	25	PCI Express 2.0 x16 card slot (SLOT4_PCI e2x16)
11	SATA connectors for hard drives or optical drives (SATA_0, SATA_1, SATA_2)	26	PCI slot (SLOT3_PCI)
12	main power connector (POWER1)	27	PCI Express 2.0 x16 card slot (SLOT2_PCI e2x16)
13	battery socket (BATTERY)	28	PCI Express x8 card slot, wired as x4 (SLOT1_PCIE)
14	RTC reset jumper (RTCST)	29	memory fan connector (FAN_MEM)
15	hard drive connectors for SAS or SATA hard drives (HDD_0, HDD_1, HDD_2), HDD_3	30	memory module connectors DIMM_1-8)

### Cable Colors

Device	Color
SATA hard drive	blue cable
Floppy drive	black pull tab
Optical drive	orange cable
front panel	yellow pull tab

## Specifications



**NOTE:** Offerings may vary by region. For more information regarding the configuration of your computer, click Start → Help and Support and select the option to view information about your computer.

### Processor


Processor type	Dual-Core Intel® Xeon® Processor 5200 series Quad-Core Intel® Xeon® Processor 5400 series
----------------	--

Internal cache	Dual-Core Intel® Xeon® Processor 5200 series - 6 MB Quad-Core Intel® Xeon® Processor 5400 series - 12 MB
External bus frequency	1333- or 1600-MHz data rate

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## Memory

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Memory module connectors	8 (16 with optional memory riser)
Memory module capacities	512-MB or 1-, 2-, or 4-GB ECC
Memory type	667- or 800-MHz fully-buffered DDR2 SDRAM fully-buffered DIMMs (FBDs)  <b>NOTICE:</b> Full-length heat spreaders (FLHS) are required for all memory.
Minimum memory	1 GB
Maximum memory	64 GB with optional memory riser cards 32 GB standard
BIOS address	F0000h

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## System Information

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System chipset	Intel 5400
Data bus width	64 bits
DRAM bus width	Quad-channel fully-buffered DIMM
Processor address bus width	38 Bits

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## System Information (continued)

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Flash EPROM	8 Mbit
Graphics bus	Two PCI Express 2.0 x16 slots

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## Expansion

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Card support	Center five connector slots support fulllength cards.
	The connector slots on either side (one x8 PCI Express slot (wired as x4) and one PCIX card) support half-length cards.
Cards supported	PCI 2.3 PCI Express 1.0A PCI Express 2.0 x16 PCI-X 2.0A
PCI	
connector	one
connector size	120 pins
connector data width (maximum)	32 bits
bus transfer rate	133 MB/s
PCI-X	
connectors	three
connector size	188 pins
connector data width (maximum)	64 bits
bus transfer rate	800 MB/s
PCI Express x8 (wired as x4)	
connectors	one x8 (support x8, x4, and x1 modes/cards; maximum x4 link width)
connector size	98 pins
connector data width (maximum)	4 PCI Express lanes
bus transfer rate	2.5 GB/s/lane/direction (raw bandwidth)
PCI Express 2.0 x16	

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### Expansion

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connector	two x16 slots (support x16, x8, x4 and x1 modes/cards)
connector size	164 pins

connector data width (maximum)	16 PCI Express lanes
bus transfer rate	5.0 GB/s/lane/direction (raw bandwidth)

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## Ports and Connectors

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### External connectors:

Serial	two 9-pin connectors; 16550C-compatible
Parallel	25-hole connector (bidirectional)
IEEE 1394	one front-panel, 6-pin connector and one rear panel, 6-pin connector
Network adapter	RJ45 connector
PS/2 (keyboard and mouse)	two 6-pin mini-DIN
USB	two front-panel and five back-panel USB 2.0-compliant connectors
Audio	two front-panel connectors for microphone and headphones; two back-panel connectors for line-in and line-out

### System board connectors:

Floppy drive	34-pin connector
SAS/Serial ATA HDD	four 7-pin connectors
Serial ATA	three 7-pin connectors
Internal USB	one 10-pin connector for optional Media Card Reader (3.5-inch bay device or secure boot device)

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## Video

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Video type	PCI Express 2.0 x16 (two slots)
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## Audio

Audio type	High Definition Audio CODEC and Azalia/High Definition digital controller
Stereo conversion	24-bit analog-to-digital; 24-bit digital-to-analog

---

## Drives

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Externally accessible	four 5.25-inch universal drive bays (can support 3.5-inch devices)
Internally accessible	four 3.5-inch hard-drive bays

---

## Key Combinations

<F2>	starts embedded system setup (during start-up only)
<F12> or <Ctrl><Alt><F8>	starts the <b>Boot Device</b> menu (during start-up only)
<Ctrl><Alt><F10>	launches the utility partition (if installed) during start-up
<F5>	runs onboard diagnostics

---

## Controls and Lights

Power control

Power light

**Front panel:** push button

**Front panel:**

green light—blinking green in sleep state; solid green for power-on state  
amber light—blinking amber indicates that an internal power problem might exist; solid amber indicates that a device may be malfunctioning or incorrectly installed (see

"Power Problems" on page 100)

---

## Controls and Lights

Hard-drive access light

**Front panel:**

green light—on when the computer reads data from or writes data to the hard drive; the light may also be on when a device such as the optical drive is operating

Link integrity lights

**Back panel:** green light for 10-Mb operation; orange light for 100-Mb operation; yellow light for a 1000-Mb (1-Gb) operation  
**Front panel:** displays solid green when a network connection is present

Activity light

**Back panel:** yellow blinking light when there is network activity

Diagnostic lights

**Front panel:** four lights (see "Diagnostic Lights" on page 105)

Standby power light

System AUX\_PWR on the system board

---

## Power

DC power supply

Wattage

1000 W

Heat dissipation

1250W or 4265 BTU/hour (system with power supply)

**NOTE:** Heat dissipation is calculated based upon the power supply wattage rating.

Voltage

auto-sensing power supply—90 V to 265 V at 50/60 Hz

Backup battery

3-V CR2032 lithium coin cell

---

## Physical

Height

22.3 in (56.6 cm)

Width

**With stand:** 12.8 in (32.5 cm)

**Without stand:** 8.5 in (21.6 cm)

Depth

21.2 in (53.8 cm)

---

## Physical

---

Approximate minimum weight

55 lb (24.9 kg)



**CAUTION: Your computer is heavy and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.**

---

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## Environmental

Temperature range

Operating 10° to 35°C (50° to 95°F)

Storage -40° to 65°C (-40° to 149°F)

Relative humidity (maximum)

Operating 20% to 80% (noncondensing)

Storage 5% to 95% (noncondensing)

Maximum vibration (using a random-vibration spectrum that simulates user environment)

Operating 5 to 350 Hz at 0.0002 G<sup>2</sup>/Hz

Storage 5 to 500 Hz at 0.001 to 0.01 G<sup>2</sup>/Hz

Maximum shock

Operating 40 G +/- 5% with pulse duration of 2 msec +/- 10% (equivalent to 20 in/sec [51 cm/sec])

Storage 105 G +/- 5% with pulse duration of 2 msec +/- 10% (equivalent to 50 in/sec [127 cm/sec])

Altitude (maximum)

Operating -15.2 to 3048 m (-50 to 10,000 ft)

Storage -15.2 to 10,668 m (-50 to 35,000 ft)

# 3 Advanced Features

## LegacySelect Technology Control

LegacySelect technology control offers legacy-full, legacy-reduced, or legacyfree solutions based on common platforms, hard-drive images, and help desk procedures. Control is provided to the administrator through system setup, Dell OpenManage™ IT Assistant, or Dell custom factory integration.

LegacySelect allows administrators to electronically activate or deactivate connectors and media devices that include serial and USB connectors, a parallel connector, a floppy drive, PCI slots, and a PS/2 mouse. Connectors and media devices that are deactivated make resources available. You must restart the computer to effect the changes.

## Manageability

### Alert Standard Format

Alert Standard Format (ASF) is a DMTF management standard that specifies "pre-operating system" or "operating system-absent" alerting techniques. The standard is designed to generate an alert on potential security and fault conditions when the operating system is in a sleep state or the computer is powered down. ASF is designed to supersede previous operating system-absent alerting technologies.

Your computer supports the following ASF alerts:

```
Chassis: Chassis Intrusion Cleared
- Physical Security
Violation/ Chassis
Intrusion - Physical
Security Violation Event
Boot: Failure to Boot to
BIOS
Password: System Password
```



Violation	The BIOS did not complete loading upon initiation.
CPU: CPU DOA Alert/CPU DOA Alert Cleared	The system password is invalid (alert occurs after three failed attempts).
Heartbeats: Entity Presence	The processor is not functioning.
Temperature: Generic Critical Temperature Problem	Periodic heartbeats have been transmitted to verify system presence. The computer temperature is out of limits.
Voltage: Generic Critical Voltage Problem	
Power Supply: Critical Power Supply Problem	The voltage from integrated voltage regulators is out of limits.
Cooling Device: Generic Critical Fan Failure	The computer power supply voltage is out of limits.
Connectivity: Ethernet Connectivity Enabled/	The fan speed (rpm) is out of limits.

Alert	Description
Ethernet Connectivity Disabled	The Ethernet connectivity is enabled or the Ethernet connectivity is disabled.
The computer chassis has been opened or the chassis intrusion alert has been cleared.	

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For more information about Dell's ASF implementation, see the *ASF User's Guide* and the *ASF Administrator's Guide*, which are available on the Dell Support website at [support.dell.com](http://support.dell.com).

## Dell OpenManage™ IT Assistant

IT Assistant configures, manages, and monitors computers and other devices on a corporate network. IT Assistant manages assets, configurations, events (alerts), and security for computers equipped with industry-standard management software. It supports instrumentation that conforms to SNMP and CIM industry standards.

Dell OpenManage Client instrumentation, which is based on CIM, is available for your computer. For information on IT Assistant, see the *Dell OpenManage IT Assistant User's Guide* available on the Dell Support website at [support.dell.com](http://support.dell.com).

## Dell OpenManage Client Instrumentation

Dell OpenManage Client Instrumentation is software that enables remote management programs, such as IT Assistant, to do the following:

- Access information about your computer, such as how many processors it has and what operating system it is running.
- Monitor the status of your computer, such as listening for thermal alerts from temperature probes or hard-drive failure alerts from storage devices.
- Change the state of your computer, such as updating its BIOS or shutting it down remotely.

A managed system is one that has Dell OpenManage Client Instrumentation set up on a network that uses IT Assistant. For information about Dell OpenManage Client Instrumentation, see the *Dell OpenManage Client Instrumentation User's Guide* available on the Dell Support website at [support.dell.com](http://support.dell.com).

## Power Management

Your computer can be set to use less power when you are not working. You control the power usage through the operating system installed on your computer and certain option settings in system setup (see "Power Management" on page 37). These periods of reduced power are called "sleep modes."



**NOTE:** All components installed in the computer must support the hibernate and/or standby mode feature(s) and have the appropriate drivers loaded to enter

either of these sleep modes. For more information, see the manufacturer's documentation for each component.

- **Standby.** In this sleep mode, power is reduced or turned off for many components. However, system memory remains active.



**NOTE:** Hibernate mode is only supported on computers with 4-GB of RAM or less.


- **Hibernate.** This sleep mode reduces power consumption to a minimum by writing all data in system memory to a hard drive and then removing system power. Waking up from this mode restarts the computer, and the memory contents are restored. Operation then resumes where the computer left off when it entered the hibernation mode.
- **Shutdown.** This sleep mode removes all power from the computer except a small auxiliary amount. As long as the computer remains connected to an electrical outlet, it can be automatically or remotely started. For example, the **Auto Power On** option in system setup (see "Power Management" on page 37) allows the computer to automatically start at a specified time. Also, your network administrator can remotely start your computer using a power management event such as Remote Wake Up.

The following table lists the sleep modes and the methods you can use to wake the computer from each mode.

Sleep Mode	Wake-Up Methods (Windows XP)
Standby	<ul style="list-style-type: none"><li>• Press the power button</li><li>• Auto power on</li><li>• Move or click the mouse</li><li>• Type on the keyboard</li><li>• USB device activity</li><li>• Power management event</li></ul>
Hibernate	<ul style="list-style-type: none"><li>• Press the power button</li><li>• Auto power on</li><li>• Power management event</li></ul>

- Shutdown
- Press the power button
  - Auto power on
  - Power management event

---


 **NOTE:** For more information on power management, see your operating system documentation.

## Hyperthreading and Multi-Core Technology

Hyperthreading is an Intel technology that can enhance overall computer performance by allowing one physical processor to function as two logical processors that are capable of performing certain tasks simultaneously. Multicore processors contain two or more physical computational units inside a single CPU package, thereby increasing computing efficiency and multitasking ability. Intel has implemented this technology in its Dual-Core and Quad-Core processors. These processors have two and four computational units respectively. It is recommended that you use the Microsoft Windows XP Service Pack 1 (SP1) or higher or Windows Vista operating systems which are optimized to take advantage of these technologies.

While many programs can benefit from hyperthreading and multi-core technology, some programs may have not been optimized for them and may require an update from the software manufacturer. Contact the software manufacturer for updates and information about using hyperthreading or multi-core technology with your software. To determine if your computer is using hyperthreading technology, check the system setup option for hyperthreading under the Performance tab (see "System Setup" on page 290).


## About RAID Configurations

 **NOTE:** RAID levels 5 and 10 are only available via an optional PCI Express RAID controller card.

 **NOTE:** RAID for SATA 1.0 is not supported.


This section provides an overview of the RAID configuration that you might have selected when you purchased your computer. Although there are several RAID configurations available in the computer industry for different types of uses, Dell offers RAID level 0, RAID level 1, or, with an optional PCI Express

RAID controller, RAID level 5 or RAID level 10 on your Dell Precision computer. A RAID level 0 configuration is recommended for highperformance programs, and a RAID level 1 configuration is recommended for users that desire a high level of data integrity. A RAID level 5 or a RAID level 10 configuration provides for both data integrity and higher access speeds.

 **NOTE:** RAID levels do not represent a hierarchy. A RAID level 5 configuration is not inherently better or worse than a RAID level 0 configuration.

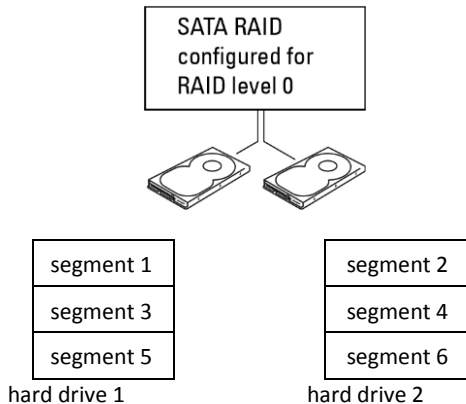
The RAID controller on your computer can only create a RAID level 0 configuration using two to four physical drives. A RAID level 5 or 10 array (only available with the optional PCI Express RAID controller) must be made up of three or four drives.

All drives must be the same type of drive; SAS and SATA drives cannot be mixed in a RAID array. The drives should also be the same size to ensure that the larger drive does not contain unallocated (and therefore unusable) space.

 **NOTE:** RAID levels do not represent a hierarchy. A RAID level 10 configuration is not inherently better or worse than a RAID level 0 configuration.

## RAID Level 0

RAID level 0 uses a storage technique known as "data striping" to provide a high data access rate. Data striping is a method of writing consecutive segments—or stripes—of data sequentially across the physical drives to create a large virtual drive. Data striping allows one of the drives to read data while the other drive is searching for and reading the next block.

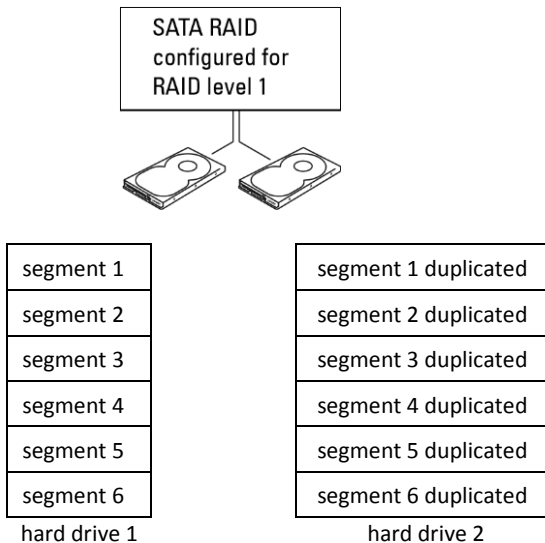


Another advantage of a RAID level 0 configuration is that it utilizes the full capacities of the drives. If you have two 120-GB drives installed, you have 240 GB on which to store data.

**NOTICE:** Because RAID level 0 provides no data redundancy, if one drive fails, then the data on the other drive is also inaccessible. Therefore, ensure that you perform regular backups when you use a RAID level 0 configuration.

## RAID Level 1

RAID level 1 uses a data-redundancy storage technique known as "mirroring." When data is written to the primary drive, the data is then duplicated—or mirrored—on the other drive. A RAID level 1 configuration sacrifices highdata access rates for its data redundancy advantages.



If a drive failure occurs, subsequent read and write operations are directed to the surviving drive. A replacement drive can then be rebuilt using the data from the surviving drive. Also, because data is duplicated on both drives, two 120-GB RAID level 1 drives collectively have a maximum of 120-GB on which to store data.

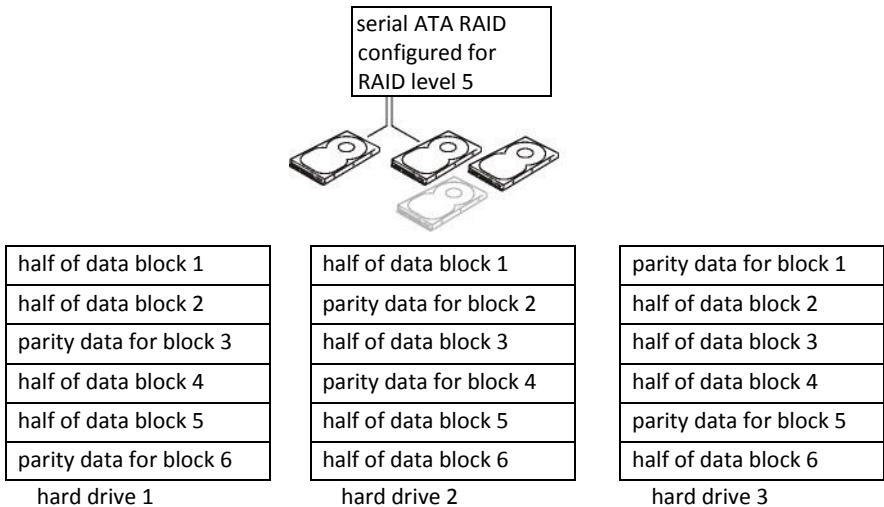
## RAID Level 5



**NOTE:** RAID levels 5 and 10 are only available via an optional PCI Express RAID controller card.

RAID level 5 uses a data-staging storage technique known as "parity checking." When a block of data is written to the RAID configuration, it is striped across all of the drives in the RAID array except for one drive, to which is written parity data. The parity data is information that allows for the entire block of striped data to be calculated if one of the drives fails.

Since parity data is fairly small when compared to the size of the actual stored data, the equivalent of one hard drive can serve as a parity drive for any number of data-storing hard drives. However, not all of the parity data is put on the same drive. Instead, with each new block of data written to the RAID configuration, the different drives alternately act as either data-storing or parity drives.



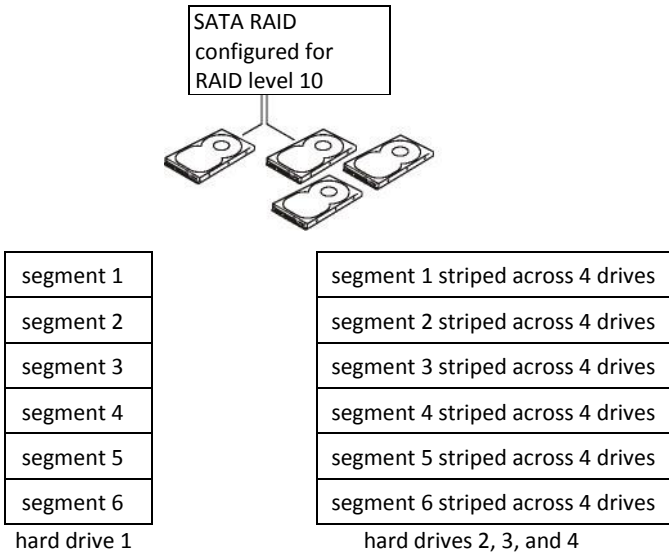
Because data is striped across the RAID configuration, as it is in a RAID 0 configuration, it can be quickly accessed. Also, because of the parity data, if only a single drive fails, that drive can be rebuilt using the parity data on the other drives. The amount of storage space available to three 120-GB RAID

level 5 drives is 240-GB on which to store data, since the equivalent of one drive is set aside for parity data. A minimum of three drives is required to create a RAID level 5 configuration.

### RAID Level 10

**NOTE:** RAID levels 5 and 10 are only available via an optional PCI Express RAID controller card.

RAID level 10 uses a combination of striping and mirroring methods. It requires four drives. The drives are broken up into mirroring pairs and then the data that is written to the RAID configuration is striped across all four drives. Data can be accessed quickly, due to the striping of data, however each piece of data is duplicated on another drive, for redundancy purposes.



If a drive failure occurs, subsequent read and write operations are directed to the other surviving drives. A replacement drive can then be rebuilt using the data from the surviving drives. Also, because data is duplicated on the primary and additional drives, four 120-GB RAID level 1 drives collectively have a maximum of 240-GB on which to store data.



## Configuring Your Computer for RAID

At some point you may want to configure your computer for RAID if you did not select a RAID configuration when you purchased your computer. You must have at least two hard drives installed in your computer to set up a RAID configuration. For instructions on how to install a hard drive, see "Installing a Hard Drive (Hard Drive Bays 1-4)" on page 235.

## RAID Configuration Utility

### Entering the RAID Configuration Utility

- 1 Boot the system.
- 2 Press <Ctrl><C> during POST when prompted.  
If you wait too long and the operating system logo appears, continue to wait until the operating system completes bootup. Then restart your system and try again.

The Configuration Utility menu screen displays.

### Navigating Within the Configuration Utility

Configuration screens are organized in a hierarchical fashion. Navigational hints are displayed at the bottom of each screen. Online help is also available in this utility.

## RAID Configuration and Management

In order to access any of the integrated RAID (IR) configuration and management screens, select **RAID Properties** on the **Adapter Properties** screen. From here you can create a new RAID volume and view or manage existing RAID volumes.

- If no RAID volumes are currently configured, you are prompted to create a RAID virtual disk (a RAID volume).
- If at least one RAID volume is currently configured, any existing RAID volumes are displayed for management purposes.



**NOTE:** Dell recommends backing up your data prior to adding or updating configurations.

## Exit Screen

It is important to exit the RAID Configuration Utility properly, because some changes take effect only when you exit. From the **Adapter List**, press <Esc> to exit. In addition, a similar exit screen appears when you exit most other screens, and it can be used to save settings.

## Performing Configuration Tasks



**NOTICE:** You will lose any data on your hard drives when you create a RAID configuration using the following procedures. Back up data that you want to keep before continuing.



**NOTE:** Your RAID array cannot exceed 2 Terabytes in size. Any space beyond the 2Terabyte limitation will not be usable.

The two options for creating a new RAID volume are **Create IM Volume** and **Create IS Volume**. IM stands for *integrated mirroring*. IS stands for *integrated striping*. Additional information is available on the configuration screen.

### Creating a RAID Level 0 Configuration



**NOTE:** RAID 0 does not provide any data protection in the event of hard drive failure. It is primarily used to increase performance.



**NOTE:** Once the number of hard drives in a RAID volume (virtual disk) is set, it cannot be changed.


Follow these steps to create a RAID 0 volume on a SAS 6/iR controller that does not currently have a RAID volume configured.

- 1 Select a controller from the **Adapter List** in the Configuration Utility.
- 2 Select the **RAID Properties** option.
- 3 Select **Create IS Volume** when you are prompted to create either an IS (striped) RAID volume or an IM (mirrored) RAID volume.

The next screen shows a list of hard drives that can be added to a RAID volume.

- 4 Move the cursor to the **RAID Disk** column. To add a hard drive to the RAID volume, change “No” to “Yes” by pressing the <+>, <->, or space

bar. As hard drives are added, the **Virtual Disk Size** field changes to reflect the new size of the RAID volume.

 **NOTICE:** All data will be lost upon creation of the RAID volume. Dell recommends backing up your data before performing these steps. When creating an IS (striped) RAID volume:

- All drives must be either Dell compliant SAS or SATA hard drives.
  - SAS and SATA hard drives cannot be used in the same RAID volume.
  - Drives must have 512 byte blocks and must not have removable media.
  - There can be at minimum of 2 and a maximum of 4 hard drives in a RAID volume.
- 5 Press <C> and then select **Save changes** when the RAID volume has been fully configured.
  - 6 Exit this menu to save the changes. The Configuration Utility will pause while the RAID volume is being created.

### Creating a RAID Level 1 Configuration

Follow these steps to create a RAID 1 volume on a SAS 6/iR controller that does not currently have a RAID volume configured.

- 1 Select a controller from the **Adapter List** in the Configuration Utility.
- 2 Select the **RAID Properties** option.
- 3 Select **Create IM Volume** when you are prompted to create either an IS (striped) RAID volume or an IM (mirrored) RAID volume.  
The next screen shows a list of hard drives that can be added to a RAID volume.
- 4 Move the cursor to the **RAID Disk** column. To add a hard drive to the RAID volume, change “No” to “Yes” by pressing the <+>, <->, or space bar. As hard drives are added, the **Virtual Disk Size** field changes to reflect the new size of the RAID volume.



**NOTICE:** All data will be lost upon creation of the RAID volume. Dell recommends backing up your data before performing these steps. When creating an IM (mirrored) RAID volume:

- All drives must be either Dell compliant SAS or SATA hard drives.
  - SAS and SATA hard drives cannot be used in the same RAID volume.
  - Drives must have 512 byte blocks and must not have removable media.
  - There can only be 2 hard drives per RAID volume.
- 5 Press <C> and then select **Save changes** when the RAID volume has been fully configured.
  - 6 Exit this menu to save the changes. The Configuration Utility will pause while the RAID volume is being created.



**NOTE:** RAID 1 provides protection against the failure of a single hard drive. When a hard drive fails, it can be replaced and the data re-mirrored to another hard drive, maintaining data integrity.

## Creating a Second RAID Volume

The SAS 6/iR controller supports two active RAID volumes. If one RAID volume is already configured, follow these steps to add a second RAID volume:

- 1 Select a controller from the **Adapter List** in the Configuration Utility.
- 2 Select the **RAID Properties** option to display the current RAID volume.
- 3 Press <C> to create a new RAID volume.
- 4 Continue to create a second RAID volume, either RAID level 0 or RAID level 1.

## Viewing RAID Volume Properties

Follow these steps to view the properties of RAID level 1 and RAID level 0 configurations:

- 1 Select a controller from the **Adapter List** in the Configuration Utility.
- 2 Select the **RAID Properties** option to display the current RAID volume.

- 3 Press <Alt><N> to view the next RAID volume if more than one RAID volume is configured.
- 4 Press <Enter> when the **Manage Virtual Disk** item is selected to manage the current RAID volume.

### Synchronizing a RAID Volume (Virtual Disk)

When a RAID volume is synchronized, the firmware synchronizes the data on the secondary hard drive(s) with the data on the primary hard drive of the RAID level 1 volume. Follow these steps to start synchronization for a RAID level 1 volume:

- 1 Select **Synchronize Virtual Disk**.
- 2 Press **Y** to start the synchronization or **N** to cancel it.

### Activating a RAID Volume

A RAID volume can become inactive if, for example, it is removed from one SAS 6/iR controller or computer and moved to another one. The **Activate Virtual Disk** option allows you to reactivate an inactive RAID volume that has been added to a system. This option is only available when the selected RAID volume is currently inactive.

- 1 Select **Activate Virtual Disk**.
- 2 Press **Y** to proceed with the activation or press **N** to abandon it.  
After a pause, the RAID volume will become active.



**NOTE:** Activation of migrated RAID volume is only supported when the migrated RAID volume is in an optimal state and contains all the installed hard drives.

### Deleting a RAID Volume



**NOTICE:** Before deleting a RAID volume, be sure to back up all data on the RAID volume that you want to keep.

Follow these steps to delete a selected RAID volume:

- 1 Select **Delete Virtual Disk**.
- 2 Press **Y** to delete the RAID volume or press **N** to cancel the deletion.  
After a pause, the RAID volume will be deleted.



**NOTICE:** If the hard drives of a RAID volume are removed and the RAID volume's configuration is subsequently deleted from the SAS 6/iR controller, the hard drives show up only as simple drives with no RAID association if they are placed back onto the same SAS 6/iR controller. Once the RAID volume is removed from a SAS 6/iR controller using the RAID Configuration Utility (regardless of whether the hard drives are present), the RAID volume cannot be restored.

## Replacing and Rebuilding a Degraded RAID Volume

In the event of a hard drive failure in a RAID level 1 volume, you will need to replace the hard drive and resynchronize the RAID volume.

- 1 Replace the failed drive with a new drive of the same type and capacity (or larger capacity).
- 2 Check your management application or the RAID Configuration Utility (Ctrl-C) to ensure synchronization started automatically.



**NOTE:** Proceed to step 3 only if synchronization does not begin automatically.

- 3 Enter the RAID Configuration Utility (Ctrl-C).
- 4 From the **Adapter List** screen, select the controller that contains the degraded RAID volume.
- 5 From the **Adapter Properties** screen, select **RAID Properties**.
- 6 Press <Alt+N> until the degraded RAID level 1 volume is in view, then select **Manage Virtual Disk**.

The screen shows the RAID volume with a status of "Degraded".

- 7 Select **Add Secondary Disk** and select a drive from the list of available drives.

The new hard drive automatically begins to sync with the drive of the degraded RAID level 1 volume.

# 4 Setting Up Your Computer

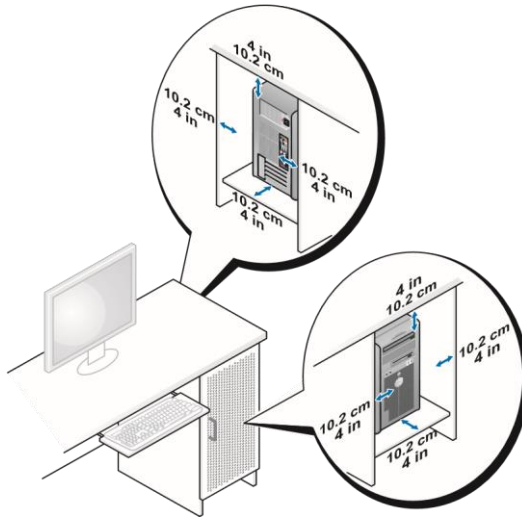
## Installing Your Computer in an Enclosure

Installing your computer in an enclosure can restrict the airflow and impact your computer's performance, possibly causing it to overheat. Follow the guidelines below when installing your computer in an enclosure:

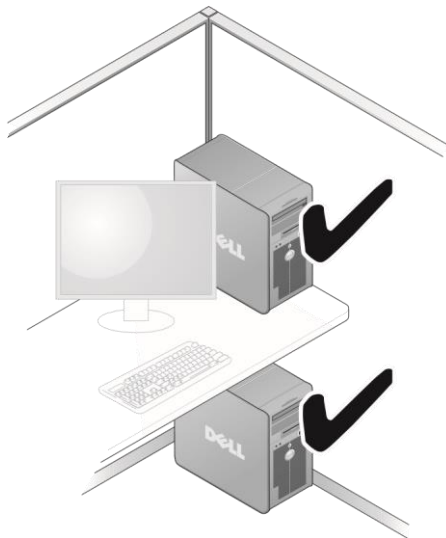


**NOTICE:** The operating temperature specifications indicated in this manual reflects the maximum ambient operating temperature. The room ambient temperature needs to be a consideration when installing your computer in an enclosure. For example, if the ambient room temperature is at 25°C (77°F), depending on your computer's specifications, you only have 5° to 10°C (9° to 18°F) temperature margin before you reach your computer's maximum operating temperature. For details about your computer's specifications, see "Specifications" on page 29.

- Leave a 10.2 cm (4 in) minimum clearance on all vented sides of the computer to permit the airflow required for proper ventilation.
- If your enclosure has doors, they need to be of a type that allows at least 30 percent airflow through the enclosure (front and back).



- If your computer is installed in a corner on a desk or under a desk, leave at least 5.1 cm (2 in) clearance from the back of the computer to the wall to permit the airflow required for proper ventilation.





**NOTICE:** Do not install your computer in an enclosure that does not allow airflow. Restricting the airflow impacts your computer's performance, possibly causing it to overheat.



## Connecting to the Internet

**NOTE:** ISPs and ISP offerings vary by country.

To connect to the Internet, you need a modem or network connection and an Internet service provider (ISP). Your ISP will offer one or more of the following Internet connection options:

- DSL connections that provide high-speed Internet access through your existing telephone line or cellular telephone service. With a DSL connection, you can access the Internet and use your telephone on the same line simultaneously.
- Cable modem connections that provide high-speed Internet access through your local cable TV line.
- Satellite modem connections that provide high-speed Internet access through a satellite television system.
- Dial-up connections that provide Internet access through a telephone line. Dial-up connections are considerably slower than DSL and cable (or satellite) modem connections.

- Wireless LAN connections that provide Internet access using Bluetooth<sup>®</sup> wireless technology.

If you are using a dial-up connection, connect a telephone line to the modem connector on your computer and to the telephone wall jack before you set up your Internet connection. If you are using a DSL or cable/satellite modem connection, contact your ISP or cellular telephone service for setup instructions.

## Setting Up Your Internet Connection

To set up an Internet connection with a provided ISP desktop shortcut:

- 1 Save and close any open files, and exit any open programs.
- 2 Double-click the ISP icon on the Microsoft<sup>®</sup> Windows<sup>®</sup> desktop.
- 3 Follow the instructions on the screen to complete the setup.

If you do not have an ISP icon on your desktop or if you want to set up an Internet connection with a different ISP, perform the steps in the following section that corresponds to the operating system your computer is using.




**NOTE:** If you cannot connect to the Internet but have successfully connected in the past, the ISP might have a service outage. Contact your ISP to check the service status, or try connecting again later.

### Windows XP

- 1 Save and close any open files, and exit any open programs.
- 2 Click **Start** → **Internet Explorer**.  
The **New Connection Wizard** appears.
- 3 Click **Connect to the Internet**.
- 4 In the next window, click the appropriate option:
  - If you do not have an ISP and want to select one, click **Choose from a list of Internet service providers (ISPs)**.
  - If you have already obtained setup information from your ISP but you did not receive a setup CD, click **Set up my connection manually**.
  - If you have a CD, click **Use the CD I got from an ISP**.
- 5 Click **Next**.


If you selected **Set up my connection manually**, continue to step 6.

Otherwise, follow the instructions on the screen to complete the setup.


 **NOTE:** If you do not know which type of connection to select, contact your ISP.

- 6 Click the appropriate option under **How do you want to connect to the Internet?**, and then click **Next**.
- 7 Use the setup information provided by your ISP to complete the setup.

### Windows Vista™

 **NOTE:** Have your ISP information ready. If you do not have an ISP, the Connect to the Internet wizard can help you get one.


- 1 Save and close any open files, and exit any open programs. **2**

Click the Windows Vista Start button , and click **Control**

**Panel 3** Under **Network and Internet**, click **Connect to the Internet**.

The **Connect to the Internet** window appears.

- 4 Click either **Broadband (PPPoE)** or **Dial-up**, depending on how you want to connect:
  - Choose **Broadband** if you will use a DSL, satellite modem, cable TV modem, or Bluetooth wireless technology connection.
  - Chose **Dial-up** if you will use a dial-up modem or ISDN.

 **NOTE:** If you do not know which type of connection to select, click Help me choose or contact your ISP.

- 5 Follow the instructions on the screen and use the setup information provided by your ISP to complete the setup.

## Transferring Information to a New Computer


You can use your operating system "wizards" to help you transfer files and other data from one computer to another—for example, from an *old* computer to a *new* computer. For instructions, see the following section that corresponds to the operating system that your computer is running.

## Microsoft® Windows® XP

The Microsoft Windows XP operating system provides the Files and Settings Transfer Wizard to move data from a source computer to a new computer. You can transfer data, such as:

- E-mail messages
- Toolbar settings
- Window sizes
- Internet bookmarks


You can transfer the data to the new computer over a network or serial connection, or you can store it on removable media, such as a writable CD, for transfer to the new computer.

 **NOTE:** You can transfer information from an old computer to a new computer by directly connecting a serial cable to the input/output (I/O) ports of the two computers. To transfer data over a serial connection, you must access the Network Connections utility from the Control Panel and perform additional configuration steps, such as setting up an advanced connection and designating the host computer and the guest computer.

For instructions on setting up a direct cable connection between two computers, see Microsoft Knowledge Base Article #305621, titled *How to Set Up a Direct Cable Connection Between Two Computers in Windows XP*. This information may not be available in certain countries.

For transferring information to a new computer, you must run the Files and Settings Transfer Wizard. You can use the optional *Operating System* disc for this process or you can create a wizard disk with the Files and Settings Transfer Wizard.

### Running the Files and Settings Transfer Wizard With the Operating System Disc

 **NOTE:** This procedure requires the *Operating System* disc. This disc is optional and may not be included with certain computers.

To prepare a new computer for the file transfer:

- 1 Open the Files and Settings Transfer Wizard: click **Start** → **All Programs** → **Accessories** → **System Tools** → **Files and Settings Transfer Wizard**.

- 2 When the **Files and Settings Transfer Wizard** welcome screen appears, click **Next**.
- 3 On the **Which computer is this?** screen, click **New Computer**→ **Next**.
- 4 On the **Do you have a Windows XP CD?** screen, click **I will use the wizard from the Windows XP CD**→ **Next**.
- 5 When the **Now go to your old computer** screen appears, go to your old or source computer. Do *not* click **Next** at this time.

To copy data from the old computer:

- 1 On the old computer, insert the *Windows XP Operating System* disc.
- 2 On the **Welcome to Microsoft Windows XP** screen, click **Perform additional tasks**.
- 3 Under **What do you want to do?**, click **Transfer files and settings**→ **Next**.
- 4 On the **Which computer is this?** screen, click **Old Computer**→ **Next**.
- 5 On the **Select a transfer method** screen, click the transfer method you prefer.
- 6 On the **What do you want to transfer?** screen, select the items you want to transfer and click **Next**.

After the information has been copied, the **Completing the Collection Phase** screen appears.

- 7 Click **Finish**.

To transfer data to the new computer:

- 1 On the **Now go to your old computer** screen on the new computer, click **Next**.
- 2 On the **Where are the files and settings?** screen, select the method you chose for transferring your settings and files and click **Next**.

The wizard reads the collected files and settings and applies them to your new computer.

When all of the settings and files have been applied, the **Finished** screen appears.

- 3 Click **Finished** and restart the new computer.

## Running the Files and Settings Transfer Wizard Without the Operating System Disc

To run the Files and Settings Transfer Wizard without the *Operating System* disc, you must create a wizard disk that will allow you to create a backup image file to removable disc.

To create a wizard disk, use your new computer with Windows XP and perform the following steps:

- 1 Open the Files and Settings Transfer Wizard: click **Start**→ **All Programs**→ **Accessories**→ **System Tools**→ **Files and Settings Transfer Wizard**.
- 2 When the **Files and Settings Transfer Wizard** welcome screen appears, click **Next**.
- 3 On the **Which computer is this?** screen, click **New Computer**→ **Next**.
- 4 On the **Do you have a Windows XP CD?** screen, click **I want to create a Wizard Disk in the following drive**→ **Next**.
- 5 Insert the removable disc, such as a writable CD, and click **OK**.
- 6 When the disk creation completes and the *Now go to your old computer* message appears, *do not* click **Next**.
- 7 Go to the old computer.

To copy data from the old computer:

- 1 On the old computer, insert the wizard disk.
- 2 Click **Start**→ **Run**.
- 3 In the **Open** field on the **Run** window, browse to the path for **fastwiz** (on the appropriate removable media) and click **OK**.
- 4 On the **Files and Settings Transfer Wizard** welcome screen, click **Next**.
- 5 On the **Which computer is this?** screen, click **Old Computer**→ **Next**.
- 6 On the **Select a transfer method** screen, click the transfer method you prefer.
- 7 On the **What do you want to transfer?** screen, select the items you want to transfer and click **Next**.

After the information has been copied, the **Completing the Collection Phase** screen appears.

- 8 Click **Finish**.

To transfer data to the new computer:

- 1 On the **Now go to your old computer** screen on the new computer, click **Next**.
- 2 On the **Where are the files and settings?** screen, select the method you chose for transferring your settings and files and click **Next**. Follow the instructions on the screen.

The wizard reads the collected files and settings and applies them to your new computer.

When all of the settings and files have been applied, the **Finished** screen appears.

- 3 Click **Finished** and restart the new computer.




**NOTE:** For more information about this procedure, search support.dell.com for document #154781 (*What Are The Different Methods To Transfer Files From My Old Computer To My New Dell™ Computer Using the Microsoft® Windows® XP Operating System?*).



**NOTE:** Access to the Dell™ Knowledge Base document may not be available in certain countries.

## Microsoft Windows Vista™

- 1 Click the Windows Vista Start button , and then click **Transfer files and settings** → **Start Windows Easy Transfer**.
- 2 In the **User Account Control** dialog box, click **Continue**.
- 3 Click **Start a new transfer** or **Continue a transfer in progress**.

Follow the instructions provided on the screen by the Windows Easy Transfer wizard.

## Power Protection Devices

Several devices are available to protect against power fluctuations and failures:

- Surge protectors
- Line conditioners
- Uninterruptible power supplies (UPS)

## Surge Protectors

Surge protectors and power strips equipped with surge protection help prevent damage to your computer from voltage spikes that can occur during electrical storms or after power interruptions. Some surge protector manufacturers include warranty coverage for certain types of damage. Carefully read the device warranty when choosing a surge protector. A device with a higher joule rating offers more protection. Compare joule ratings to determine the relative effectiveness of different devices.



**NOTICE:** Most surge protectors do not protect against power fluctuations or power interruptions caused by nearby lightning strikes. When lightning occurs in your area, disconnect the telephone line from the telephone wall jack and disconnect your computer from the electrical outlet.

Many surge protectors have a telephone jack for modem protection. See the surge protector documentation for modem connection instructions.



**NOTICE:** Not all surge protectors offer network adapter protection. Disconnect the network cable from the network wall jack during electrical storms.

## Line Conditioners



**NOTICE:** Line conditioners do not protect against power interruptions.

Line conditioners are designed to maintain AC voltage at a fairly constant level.

## Uninterruptible Power Supplies



**NOTICE:** Loss of power while data is being saved to the hard drive may result in data loss or file damage.




**NOTE:** To ensure maximum battery operating time, connect only your computer to a UPS. Connect other devices, such as a printer, to a separate power strip that provides surge protection.

A UPS protects against power fluctuations and interruptions. UPS devices contain a battery that provides temporary power to connected devices when AC power is interrupted. The battery charges while AC power is available. See the UPS manufacturer documentation for information on battery operating time and to ensure that the device is approved by Underwriters Laboratories (UL).



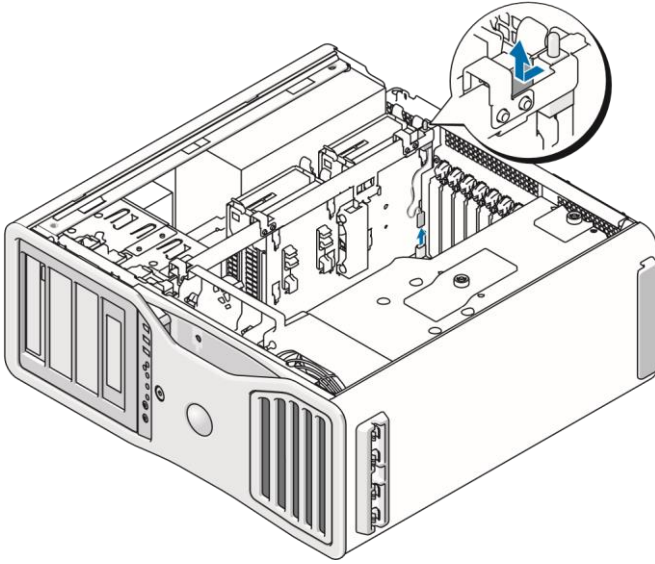
# 5 Securing Your Computer

## Chassis Intrusion Detection

-  **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.
-  **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.
-  **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

## Removing the Chassis Intrusion Switch

- 1 Follow the procedures in "Before You Begin" on page 139.
- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Disconnect the chassis intrusion switch cable from the system board.  
Note the routing of the chassis intrusion switch cable as you remove it from the chassis. Chassis hooks may hold the cable in place inside the chassis.
- 4 Slide the chassis intrusion switch out of its slot, and remove the switch and its attached cable from the computer.



## Replacing the Chassis Intrusion Switch

- 1 Gently slide the chassis intrusion switch into its slot and reconnect the cable to the system board.
- 2 Replace the computer cover (see "Replacing the Computer Cover" on page 145).

**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

- 3 Connect your computer and devices to electrical outlets, and turn them on.

## Resetting the Chassis Intrusion Detector

- 1 Turn on (or restart) your computer.
- 2 When the blue DELL™ logo appears, press <F2> immediately.

If you wait too long and the operating system logo appears, continue to wait until you see the Microsoft® Windows® desktop. Then shut down your computer (see "Turning Off Your Computer" on page 139) and try again.

- 3 Enter the system setup program (see "System Setup" on page 75).

- 4 Press the down-arrow key to move to the **Security** option.
- 5 Press <Enter> to access the menu.
- 6 Use the down-arrow key to select **Intrusion Alert**.
- 7 Use the left- and right-arrow keys to select **Reset**, and then choose **On**, **On-Silent**, or **Disabled**.



**NOTE:** The default setting is On-Silent.

- 8 Restart the computer and implement your changes.

## Security Cable Lock

Use one of the following methods to secure your computer:

- Use a padlock alone or a padlock and looped security cable with the padlock ring.

A padlock alone prevents the computer from being opened.

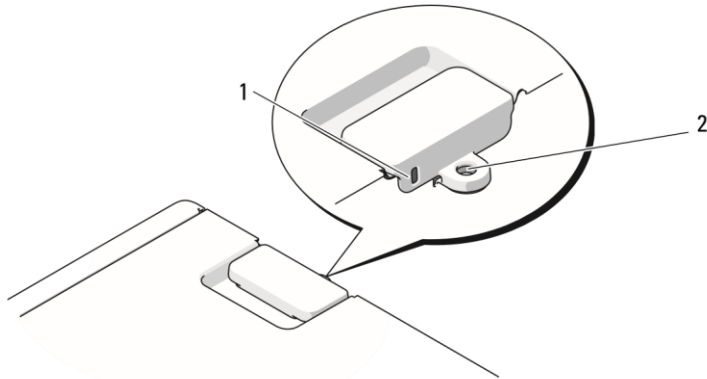
A security cable looped around a stationary object is used in conjunction with a padlock to prevent unauthorized movement of the computer.

- Attach a commercially available antitheft device to the security cable slot on the back of the computer.



**NOTE:** Before you purchase an antitheft device, make sure that it works with the security cable slot on your computer.

Antitheft devices usually include a segment of metal-stranded cable with an attached locking device and key. The documentation that comes with the device contains instructions for installing it.



---


1 security cable slot

2 padlock ring

---

## Passwords

### About Passwords

 **NOTE:** Passwords are disabled when you receive your computer.

A primary (or system) password, an administrator password, and a hard drive password all prevent unauthorized access to your computer in different ways. The following table identifies types and features of passwords available on your computer.

Type of Password	Features
Primary (or system)	<ul style="list-style-type: none"><li>• Protects the computer from unauthorized access</li></ul>
Administrator	<ul style="list-style-type: none"><li>• Gives system administrators or service technicians access to computers for repair or reconfiguration</li><li>• Allows you to restrict access to system setup in the same way a primary password restricts access to the computer</li></ul>
Hard drive	<ul style="list-style-type: none"><li>• Can be used instead of the primary password</li><li>• Helps protect the data on your hard drive or external hard drive (if one is being used) from unauthorized access</li></ul>



**NOTE:** Some hard drives do not support hard drive passwords.



**NOTICE:** Passwords provide a high level of security for data in your computer or hard drive. However, they are not foolproof. If you require more security, obtain and use additional forms of protection, such as smart cards, data encryption programs, or PC Cards with encryption features.

When using passwords, observe the following guidelines:

- Choose passwords that you can remember, but not ones that are easy to guess. For example, do not use the names of family members or pets for passwords.
- It is recommended that you do not write down passwords. If you do write it down, however, ensure that the password is stored in a secure place.
- Do not share passwords with other people.
- Ensure that people are not watching you when you type your password(s).

If you forget any of your passwords, contact Dell (see "Contacting Dell" on page 287). For your protection, Dell technical support staff will ask you for proof of your identity to ensure that only an authorized person can use the computer.

## Using a Primary (or System) Password



**NOTICE:** If you leave your computer running and unattended without having a system password assigned, or if you leave your computer unlocked so that someone can disable the password by changing a jumper setting, anyone can access the data stored on your hard drive.

### Option Settings

You cannot change or enter a new system password if either of the following two options is displayed:

- **Set** — A system password is assigned.
- **Disabled** — The system password is disabled by a jumper setting on the system board.

You can only assign a system password when the following option is displayed:

- **Not Set** — No system password is assigned and the password jumper on the system board is in the enabled position (the default setting).

## Assigning a System Password

To escape from the field without assigning a system password, press <Esc> at any time before you complete step 5.

- 1 Enter the system setup program (see "System Setup" on page 75) and verify whether an **Unlock Setup** field is present under **Security**.
- 2 If the **Unlock Setup** field is present:
  - a Use the arrow keys to navigate to the **Unlock Setup** field.
  - b Press <Enter> to access the field.
  - c Type in the administrator password and press <Enter>.
- 3 Use the arrow keys to navigate to the **System Password** field, and then press <Enter>.
- 4 Type your new password into the **New Password** field.  
You can use up to 15 characters. To erase a character when entering your password, press <Backspace> or the left-arrow key. The password is not case sensitive.

Certain key combinations are not valid. If you enter one of these combinations, the speaker emits a beep.

As you press each character key (or the spacebar for a blank space), a placeholder appears in the field.

- 5 Press <Enter>.  
If the new system password is less than 15 characters, the whole field fills with placeholders.
- 6 To confirm your password, type it a second time in the **Confirm New Password** field and press <Enter>.
- 7 Press <Enter> at the prompt.  
The system password setting changes to **Set**.
- 8 Exit the system setup program.  
Password protection takes effect when you restart the computer.

## Typing Your System Password

When you start or restart your computer, the following prompt appears on the screen:

```
Type the system password and press <Enter>.
Enter password:
```

If you have assigned an administrator password, the computer accepts your administrator password as an alternate system password.

If you type a wrong or incomplete system password, the following message appears on the screen:

```
** Incorrect password. **
```

If you again type an incorrect or incomplete system password, the same message appears on the screen. The third and subsequent times you type an incorrect or incomplete system password, the computer displays the following message:

```
** Incorrect password. **
Number of unsuccessful password attempts: 3
System halted! Must power down.
```

Even after your computer is turned off and on, the previous message is displayed each time you type an incorrect or incomplete system password.



**NOTE:** You can use Password Changes in conjunction with System Password and Admin Password to further protect your computer from unauthorized changes.

## Deleting or Changing an Existing System Password

To escape from the field without assigning a system password, press <Esc> at any time before you complete step 5.

- 1 Enter the system setup program (see "System Setup" on page 75) and verify whether an **Unlock Setup** field is present under **Security**.
- 2 If the **Unlock Setup** field is present:
  - a Use the arrow keys to navigate to the **Unlock Setup** field.
  - b Press <Enter> to access the field.
  - c Type in the administrator password and press <Enter>.
- 3 Use the arrow keys to navigate to the **System Password** field, and then press <Enter>.

- 4 Type your password into the **Old Password** field.
- 5 If you are changing an existing password, follow the instructions in "Assigning a System Password" on page 66, starting from step 4.
- 6 If you are deleting a password, press <Enter> in **New Password** field, leaving the field blank.
- 7 Press <Enter> a second time, in the **Confirm New Password** field, leaving the field blank.
- 8 Confirm that **Not Set** is displayed for the **System Password** setting. If **Not Set** is displayed, the system password has been deleted. If **Not Set** is *not* displayed, then repeat step 3 through step 8.
- 9 Exit the system setup program.

## Using an Administrator Password

### Option Settings

You cannot change or enter a new administrator password if the following option is displayed:


- **Disabled** — The administrator password is disabled by a jumper setting on the system board.

You can only assign an administrator password when one of the following options is displayed:

- **Set** — An administrator password is assigned.
- **Not Set** — No administrator password is assigned and the password jumper on the system board is in the enabled position (the default setting).

### Assigning an Administrator Password

The administrator **password** can be the same as the system password. To escape from the field without assigning a system password, press <Esc> at any time before you complete step 5.

 **NOTE:** If the two passwords are different, the administrator password can be used as an alternate system password. However, the system password cannot be used in place of the administrator password.



- 1 Enter the system setup program (see "System Setup" on page 75) and verify whether an **Unlock Setup** field is present under **Security**.
- 2 If the **Unlock Setup** field is present:
  - a Use the arrow keys to navigate to the **Unlock Setup** field.
  - b Press <Enter> to access the field.
  - c Type in the administrator password and press <Enter>.
- 3 Use the arrow keys to navigate to the **Admin Password** field, and then press <Enter>.
- 4 Type your new password into the **New Password** field.  
You can use up to 15 characters. To erase a character when entering your password, press <Backspace> or the left-arrow key. The password is not case sensitive.

Certain key combinations are not valid. If you enter one of these combinations, the speaker emits a beep.


As you press each character key (or the spacebar for a blank space), a placeholder appears in the field.

- 5 Press <Enter>.  
If the new administrator password is less than 15 characters, the whole field fills with placeholders.
- 6 To confirm your password, type it a second time in the **Confirm New Password** field and press <Enter>.
- 7 Press <Enter> at the prompt.  
The administrator password setting changes to **Set**.
- 8 Exit the system setup program.  
A change to **Admin Password** becomes effective immediately (no need to restart the computer).

### **Operating Your Computer With an Administrator Password Enabled**

When you enter the system setup program (see "System Setup" on page 75), the **Unlock Setup** option is displayed.

If you do not type the correct administrator password into the **Unlock Setup** field, the computer lets you view, but not modify, system setup options.

 **NOTE:** You can use Password Changes in conjunction with Admin Password to protect the system password from unauthorized changes.

### Deleting or Changing an Existing Administrator Password


To change an existing administrator password, you must know the administrator password. To escape from the field without assigning a system password, press <Esc> at any time before you complete step 5.

- 1 Enter the system setup program (see "System Setup" on page 75).
- 2 Use the arrow keys to navigate to the **Admin Password** field, and then press <Enter>.
- 3 Type your password into the **Old Password** field.
- 4 If you are changing an existing password, follow the instructions in "Assigning an Administrator Password" on page 69, starting from step 4.
- 5 If you are deleting a password, press <Enter> in **New Password** field, leaving the field blank.
- 6 Press <Enter> a second time, in the **Confirm New Password** field, leaving the field blank.
- 7 Confirm that **Not Set** is displayed for the **Admin Password** setting.  
If **Not Set** is displayed, the administrator password has been deleted. If **Not Set** is *not* displayed, then repeat step 3 through step 8.
- 8 Exit system setup.

### Disabling a Forgotten Password and Setting a New Password

To reset system and/or administrator passwords, see "Trusted Platform Module (TPM)" on page 71.

## Trusted Platform Module (TPM)

 **NOTE:** The TPM feature supports encryption only if the operating system supports TPM. For more information, see the TPM software documentation and the help files that came with the software.

TPM is a hardware-based security feature that can be used to create and manage computer-generated encryption keys. When combined with security software, the TPM enhances existing network and computer security by enabling features such as file protection capabilities and protected e-mail. The TPM feature is enabled through a system setup option.



**NOTICE:** To secure your TPM data and encryption keys, follow the backup procedures documented in the *Broadcom Secure Foundation Getting Started Guide*. In the event of these backups being incomplete, lost, or damaged, Dell will be unable to assist in the recovery of encrypted data.

## Enabling the TPM Feature

- 1 Enable the TPM software:
  - a Restart the computer and press <F2> during the Power On Self Test to enter the system setup program.
  - b Select **Security** → **TPM Security** and press <Enter>. **c**  
Under **TPM Security**, select **On** and press <Enter>. **d**  
Press <Esc> to exit the setup program.
  - e If prompted, click **Save/Exit**.
- 2 Activate the TPM setup program:
  - a Restart the computer and press <F2> during the Power On Self Test to enter the system setup program.
  - b Select **Security** → **TPM Activation** and press <Enter>. **c**  
Under **TPM Activation**, select **Activate** and press <Enter>.



**NOTE:** You only need to activate the program once.

- d Once the process is complete, the computer either restarts automatically or prompts you to restart your computer.

## Security Management Software

The security management software is designed to utilize four different features to help you secure your computer:

- Log-in management

- Pre-boot authentication (using a fingerprint reader, smart card, or password)
- Encryption
- Private information management

## Activating the Security Management Software



**NOTE:** You must first enable the TPM in order for the security management software to have full functionality.

- 1 Enable the TPM feature (see "Enabling the TPM Feature" on page 71).
- 2 Load the security management software.

## Using the Security Management Software

For information about how to use the software and the different security features, see the *Getting Started Guide* for the software:

Click **Start** → **All Programs** → **Wave EMBASSY Trust Suite** → **Getting Started Guide**.

## Computer Tracking Software

Computer tracking software may enable you to locate your computer if it is lost or stolen. The software is optional and may be purchased when you order your Dell™ computer, or you can contact your Dell sales representative for information about this security feature.



**NOTE:** Computer tracking software may not be available in certain countries.



**NOTE:** If you have computer tracking software and your computer is lost or stolen, you must contact the company that provides the tracking service to report the missing computer.

## If Your Computer Is Lost or Stolen

- Call a law enforcement agency to report the lost or stolen computer. Include the Service Tag in your description of the computer. Ask that a case number be assigned and write down the number, along with the name, address, and phone number of the law enforcement agency. If possible, obtain the name of the investigating officer.



**NOTE:** If you know where the computer was lost or stolen, call a law enforcement agency in that area. If you do not know, call a law enforcement agency where you live.

- If the computer belongs to a company, notify the security office of the company.
- Contact Dell customer service to report the missing computer. Provide the computer Service Tag, the case number, and the name, address, and phone number of the law enforcement agency to which you reported the missing computer. If possible, give the name of the investigating officer.

The Dell customer service representative will log your report under the computer Service Tag and record the computer as missing or stolen. If someone calls Dell for technical assistance and gives your Service Tag, the computer is identified automatically as missing or stolen. The representative will attempt to get the phone number and address of the caller. Dell will then contact the law enforcement agency to which you reported the missing computer.

# 6 System Setup

## Overview

Use System Setup as follows:

- To change the system configuration information after you add, change, or remove any hardware in your computer
- To set or change a user-selectable option such as the user password
- To read the current amount of memory or set the type of hard drive installed

Before you use System Setup, it is recommended that you write down the System Setup screen information for future reference.



**NOTICE:** Unless you are an expert computer user, do not change the settings for this program. Certain changes can make your computer work incorrectly.

## Entering System Setup

- 1 Turn on (or restart) your computer.
- 2 When the blue DELL™ logo is displayed, you must watch for the F2 prompt to appear.
- 3 Once this F2 prompt appears, press <F2> immediately.



**NOTE:** The F2 prompt indicates that the keyboard has initialized. This prompt can appear very quickly, so you must watch for it to display, and then press <F2>. If you press <F2> before you are prompted, this keystroke will be lost.

- 4 If you wait too long and the operating system logo appears, continue to wait until you see the Microsoft® Windows® desktop. Then, shut down your computer and try again.

## System Setup Options



**NOTE:** Depending on your computer and installed devices, the items listed in this section may not be present or may not appear exactly as listed.

---

<b>System</b>	
System Info	Displays the <b>Computer</b> name, <b>BIOS Version</b> number, <b>BIOS Date</b> , <b>Service Tag</b> , <b>Express Service Code</b> , and <b>Asset Tag</b> .
Processor Info	Displays the following information for the processor installed in the system: <ul style="list-style-type: none"><li>• <b>Processor Type</b></li><li>• <b>Processor Clock Speed</b></li><li>• <b>Processor Bus Speed</b></li><li>• <b>Processor L2 Cache Size</b></li><li>• <b>Processor ID</b> number</li><li>• Family, Model, and Stepping</li><li>• Microcode Version</li><li>• whether the processor is <b>Hyperthreading</b> or <b>Multi-core Capable</b></li><li>• if the processor supports <b>64-bit Technology</b></li></ul>
Memory Info	Displays the amount of <b>Installed Memory</b> , <b>Memory Speed</b> , <b>Memory Channel Mode</b> , and a description of the <b>Memory Technology</b> . This option also displays a table that describes the memory size, whether the memory module is ECC capable, single or dual rank, type, and organization.
PCI Info	Displays the contents of each PCI, PCI Express, and PCI-X slot.
Date/Time	Controls the system's internal calendar and clock.
Boot Sequence ( <b>Diskette drive</b> default)	Determines the order in which the system searches for boot devices during system startup. <p><b>NOTE:</b> If you insert a boot device and restart the computer, this option appears in the system setup menu. To boot from a USB memory device, select the USB device and move it so it becomes the first device in the list.</p>

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## Drives

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SAS  
Controller

Enables (**On**) or disables (**Off**) a SAS drive.

Diskette  
Drive  
(**Internal**  
default)

Enables and disables the floppy drives and sets read permission for the internal floppy drive. **Off** disables all floppy drives. **USB** disables the internal diskette drive and enables a USB floppy drive, if the USB controller is enabled and a USB drive is connected. **Internal** enables the internal floppy drive. **Read Only** enables the internal drive controller and allows the internal floppy drive read-only permission.

**NOTE:** Operating systems with USB support will recognize USB floppy drives regardless of this setting.

SATA 0  
through 2  
(**On** default)

Enables (**On**) or disables (**Off**) a SATA drive.

Displays the **Controller** type (**SATA**), **Port** number the drive is using, **Drive ID** number, and Capacity.

SATA  
Operation  
(**AHCI**  
default)

Determines the integrated SATA controller's operating mode, which can be either **AHCI** or **ATA**.

SMART  
Reporting  
(**Off**  
default)

Controls whether errors for integrated drives are reported during startup.

---

## Onboard Devices

---

Integrated  
NIC  
(**On** default)

Enables or disables the integrated NIC controller. Settings are **On**, **Off**, **On w/RPL**, or **On w/PXE**. When the **On w/PXE** or the **On w/RPL** setting is active, if a boot routine is not available from the network server, the computer attempts to boot from the next device in the boot sequence list.



---

Integrated Audio ( <b>On</b> default)	Enables ( <b>On</b> ) or disables ( <b>Off</b> ) the onboard audio controller. You can also select <b>Auto</b> to use the add-in Audio controller.
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1394 Controller	Enables ( <b>On</b> ) or disables ( <b>Off</b> ) a 1394 controller.
-----------------	---

---

USB Controller ( <b>On</b> default)	Enables or disables the internal USB controller. <b>No Boot</b> enables the controller but disables the ability to boot from a USB device.
--	--

**NOTE:** Operating systems with USB support will recognize USB floppy drives regardless of the No Boot setting.

---

Front USB Ports ( <b>On</b> default)	Enables or disables the front USB ports.
---	--

---

LPT Port Mode ( <b>PS/2</b> default)	Determines the mode of operation of the internal parallel port. <b>Off</b> disables the port. <b>AT</b> configures the port for AT compatibility. <b>PS/2</b> configures the port for PS/2 compatibility. <b>EPP</b> configures the port for the EPP bidirectional protocol. <b>ECP</b> configures the port for the ECP bidirectional protocol. <b>NOTE:</b> If you set the LPT Port Mode to ECP, the LPT Port DMA appears in the option menu.
---	---

---

LPT Port Address	Determines the address that the built-in parallel port uses.
------------------	--

---

Serial Port #1 ( <b>Auto</b> default)	Determines how the serial port operates. <b>Off</b> disables the port. <b>Auto</b> , the default setting, automatically configures a connector to a particular designation ( <b>COM1</b> or <b>COM3</b> ).
--	---

---

Serial Port #2 ( <b>Auto</b> default)	Determines how the serial port operates. <b>Off</b> disables the port. <b>Auto</b> , the default setting, automatically configures a connector to a particular designation ( <b>COM2</b> or <b>COM4</b> ).
--	---

---

PS/2 Mouse Port ( <b>On</b> default)	Enables or disables the integrated legacy PS/2-compatible mouse controller.
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## Video

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Primary Video  
(**Option 1** default)

This field allows the user to specify the order in which the system assigns the primary video controller when two or more controllers are available in the system. This selection is necessary only if there are two or more video controllers present.

Option 1

- PCI/PCI-X Slots
- PCIe Slot2
- PCIe Slot4

Option 2

- PCIe Slot4
- PCIe Slot2
- PCI/PCI-X Slots

The factory default setting is Option 1

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## Performance

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SpeedStep  
(**Off** default)

Enables Intel® SpeedStep® for all supported processors in the computer. This setting changes the processor power consumption and frequency.

**NOTE:** This option may not be available on your computer.

VT for Direct I/O  
(**Off** default)

Specifies whether a virtual monitor (VMM) can use additional hardware capabilities provided by Intel Virtualization Technology for direct I/O.

Virtualization  
(**Off** default)

Specifies whether a virtual machine monitor (VMM) can utilize the additional hardware capabilities provided by Intel Virtualization technology.

Limit CPUID Value  
(**Off** default)

Limits the max value the processor standard CPUID function will support. Some operating systems won't complete installation when the max CPUID function

( supported is greater than 3.

HDD Acoustic Mode	<p>Optimizes the drive's performance and acoustic levels.</p> <ul style="list-style-type: none"> <li>• Bypass - do nothing (needed for older drives)</li> <li>• Quiet - slower, but quieter</li> <li>• Suggested - allows the drive manufacturer to select mode</li> <li>• Performance - faster, but noisier.</li> </ul>
Snoop Filter	Enabling the snoop filter typically improves performance by reducing snoop traffic on the frontside bus in dual processor configurations.
ACL Prefetch	When enabled, the Adjacent Cache Line Prefetcher fetches both cache lines that comprise a cache line pair when it determines required data is not currently in its cache. When disabled, the processor will only fetch the cache line required by the processor.
HW Prefetch	Fetches an extra line of data into L2 from external memory.
FSB Optimization	Allows users to turn on/off optimization for highbandwidth, Front-Side bus applications.

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## Security

Unlock Setup <b>Locked</b> default)	When an administrator password is being used, allows the user access to modify system setup settings. Enter the administrator password at the prompt to unlock system setup. If the correct password is not entered here, the user can view but not modify system setup fields.
Admin Password <b>(Not Set</b> default)	Displays the current status of your system setup program's password security feature and allows you to verify and assign a new admin password.
System Password <b>Not Set</b> ( default)	Displays the current status of the system's password security feature and allows a new system password to be assigned and verified.

Password Changes ( <b>Unlocked</b> default)	Determines the interaction between the <b>System</b> password and the <b>Admin</b> password. <b>Locked</b> prevents a user without a valid <b>Admin</b> password from being able to modify the <b>System</b> password. <b>Unlocked</b> allows a user with a valid <b>System</b> password to modify the system password.
Chassis Intrusion ( <b>On-Silent</b> default)	When enabled, this option alerts the user, during the next computer start-up, that the computer cover has been opened. The settings are <b>On</b> , <b>On-Silent</b> (default setting), and <b>Off</b> .
Intrusion Alert	Acknowledges and clears a chassis intrusion alert.
TPM Security ( <b>Off</b> default)	Enables or disables the Trusted Platform Module security device.
Execute Disable ( <b>On</b> default)	Enables or disables Execute Disable memory protection technology.
Computrace®	Activates or disables the BIOS module interface of the optional Computrace service from Absolute Software.

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### Power Management

AC Recovery ( default) Determines how the system responds when AC power is re**Off** applied after a power loss. **Off** commands the system to stay off when the power is re-applied. You must press the front-panel power button before the system turns on. **On** commands the system to turn on when the power is reappplied. **Last** commands the system to return to the last power state the system was in just before it was turned off.

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Auto Power On ( **Off** ) Sets the computer to automatically turn on. **Off** disables this feature. **Everyday** turns the computer on every day at the time set in **Auto Power Time**. **Weekdays** turns the computer on

default) every day from Monday through Friday at the time set in

**Auto Power Time.**

**NOTE:** This feature does not work if you turn off your computer using a power strip or surge protector.

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Auto Power Time	Sets time to automatically turn on the computer. Time is kept in the standard 12-hour format ( <i>hours:minutes</i> ). Change the startup time by pressing the right- or left-arrow key to increase or decrease the numbers, or type numbers in both the date and time fields.
Low Power Mode ( <b>Off</b> default)	When <b>Low Power Mode</b> is selected, remote wakeup events will no longer power up the computer from <b>Hibernate</b> or <b>Off</b> via the onboard network controller.
Remote Wakeup ( <b>Off</b> default)	This option allows the system to power up when a Network Interface Controller (NIC) or Remote Wakeup-capable modem receives a wake up signal. <b>On</b> is the default setting. <b>On w/ Boot to NIC</b> will allow the computer to attempt to boot from a network prior to using the boot sequence. <b>NOTE:</b> Normally, the system can be powered up remotely from suspend mode, hibernate mode, or when powered off. When Low Power Mode (in the Power Management menu) is enabled, the system can only be powered up remotely from Suspend.
Suspend Mode	Sets the computer's suspend mode. The options are <b>S1</b> , a suspend state in which the computer is running in a lowpower mode, and <b>S3</b> , a suspend state in which the power is reduced or turned off for many components, however, system memory remains active.

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**Maintenance**

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Service Tag	Displays the service tag for your computer.
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ASF Mode	<p>Controls ASF management.</p> <ul style="list-style-type: none"> <li>• On = Full ASF 2.0 functionality (RMCP)</li> <li>• Alert Only - send ASF messages on event or error</li> <li>• Off - all ASF functionality disabled</li> </ul>
SERR Message	<p>Some graphics cards require that the SERR message be (On default) disabled.</p>
Load Defaults	<p>Restores system setup options to their factory defaults.</p>
Event Log	<p>Allows you to view the <b>Event Log</b>. Entries are marked <b>R</b> for <b>Read</b> and <b>U</b> for <b>Unread</b>. <b>Mark All Entries Read</b> puts an <b>R</b> to the left of all the entries. <b>Clear Log</b> clears the <b>Event Log</b>.</p>
<p><b>POST Behavior</b></p>	
Fast Boot (On default)	<p>When enabled, this feature reduces computer startup time by bypassing some compatibility steps. <b>Off</b> does not skip any steps during computer startup. <b>On</b> starts the system more quickly.</p>
Numlock Key (On default)	<p>Determines the functionality of the numeric keys on the right side of your keyboard. <b>Off</b> commands the right keypad keys to function as arrows. <b>On</b> commands the right keypad keys to function as numbers.</p>
OS Install (Off default)	<p>Determines the maximum amount of system memory available to the operating system. When set to <b>Off</b>, all system memory is available to the operating system. When set to <b>On</b>, the maximum amount of memory available to the operating system is 256 MB.</p> <p><b>NOTE:</b> Some operating systems will not complete installation with more than 2 GB of system memory.</p>

POST Hotkeys	Determines whether the sign-on screen displays a message stating the keystroke sequence that is required to enter the <b>Setup</b> program or the <b>Quickboot</b> feature. <b>Setup &amp; Boot Menu</b> displays both messages (F2=Setup and F12=Boot Menu). <b>Setup</b> displays the setup message only (F2=Setup). <b>Boot Menu</b> displays the <b>Quickboot</b> message only (F12=Boot Menu). <b>None</b> displays no message.
Keyboard Errors	<p>When set to <b>Report</b> (enabled) and an error is detected during POST, the BIOS will display the error message and prompt you to press &lt;F1&gt; to continue or press &lt;F2&gt; to enter the system setup program.</p> <p>When set to <b>Do Not Report</b> (disabled) and an error is detected during POST, the BIOS will display the error message and continue booting the system.</p>

## Boot Menu

This feature allows you to change the boot sequence for devices.

### Option Settings

- **Onboard or USB Floppy Drive** — The computer attempts to boot from the floppy drive. If the floppy disk in the drive is not bootable, if no floppy disk is in the drive, or if there is no floppy drive installed in the computer, the computer generates an error message.
- **Hard Drive** (listed by serial number when in AHCI mode) — The computer attempts to boot from the selected hard drive.



**NOTE:** In AHCI mode, all bootable hard drives are listed, not just the boot drive.


- **Onboard or USB CD-ROM Drive** — The computer attempts to boot from the CD-ROM drive. If no CD is in the drive, or if the CD has no operating system, the computer generates an error message.
- **USB Device** — Insert the memory device into a USB port and restart the computer. When `F12 = Boot Menu` appears in the upper-right corner of the screen, press <F12>. The BIOS detects the device and adds the USB option to the boot menu.



**NOTE:** To boot to a USB device, the device must be bootable. To make sure that your device is bootable, check the device documentation.

## Selecting the Boot Device for the Current Boot

You can use this feature, for example, to restart your computer to a USB device such as a floppy drive, memory key, or CD-RW drive.

 **NOTE:** If you are booting to a USB floppy drive, you must first set the Diskette Drive to USB in system setup (see "System Setup Options" on page 75).


- 1 If you are booting to a USB device, connect the USB device to a USB connector (see "About Your Computer" on page 21).
- 2 Turn on (or restart) your computer.
- 3 When **F2 = Setup**, **F12 = Boot Menu** appears in the upper-right corner of the screen, press <F12>.

If you wait too long and the operating system logo appears, continue to wait until you see the Microsoft Windows desktop. Then shut down your computer and try again.

A menu appears.


- 4 Use the up- and down-arrow keys to navigate to **Boot Device Menu**, then press <Enter> to select the option.
- 5 The **Boot Device Menu** appears, listing all available boot devices.
- 6 Use the up- and down-arrow keys to navigate to the device (that is to be used for the current boot only).
- 7 Press <Enter> to select the device.

For example, if you are booting to a USB memory key, highlight **USB Device** and press <Enter>.

 **NOTE:** To boot to a USB device, the device must be bootable. To make sure your device is bootable, check the device documentation.

## Changing Boot Sequence for Future Boots

- 1 Enter the system setup program (see "System Setup" on page 75).
- 2 Use the arrow keys to highlight the **Boot Sequence** menu option and press <Enter> to access the menu.

 **NOTE:** Write down your current boot sequence in case you want to restore it.

- 3 Press the up- and down-arrow keys to move through the list of devices.
- 4 Press the spacebar to enable or disable a device.



- 5 Press <U> and <D> to move a selected device up or down the list.

## Booting to a USB Device



**NOTE:** To boot to a USB device, the device must be bootable. To ensure that your device is bootable, check the device documentation.

### Memory Key

- 1 Insert the memory key into a USB port and restart the computer.
- 2 When `F12 = Boot Menu` appears in the upper-right corner of the screen, press <F12>. The BIOS detects the device and adds the USB device option to the boot menu.
- 3 See "Selecting the Boot Device for the Current Boot" on page 84.

### Floppy Drive

- 1 In system setup, set the **Diskette Drive** option to **USB**.
- 2 Save your changes and exit system setup.
- 3 Connect the USB floppy drive, insert bootable media, and re-boot the system.
- 4 See "Selecting the Boot Device for the Current Boot" on page 84.

# 7

## Clearing Forgotten Passwords

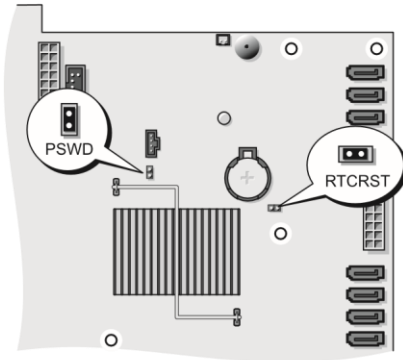






**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.





**NOTICE:** This process erases both the system and the administrator passwords.

1 Follow the procedures in "Before You Begin" on page 139.



Jumper	Setting	Description
PSWD		Password features are enabled (default setting).
		Password features are disabled.
RTCRST		The real-time clock has not been reset (default setting).
		The real-time clock is being reset.

 *jumped*     *unjumpered*

2 Remove the computer cover (see "Removing the Computer Cover" on page 141).

## Clearing Forgotten Passwords

- 3 Locate the 2-pin password jumper (PSWD) on the system board, and remove the jumper plug; set the plug aside. For help locating the jumper, see "System Board Components" on page 27.



**NOTE:** When you receive your computer, the password jumper plug is on the password jumper.

- 4 Replace the computer cover (see "Replacing the Computer Cover" on page 145).
- 5 Connect your computer and monitor to electrical outlets, and turn them on.
- 6 After the Microsoft® Windows® desktop appears on your computer, shut down your computer (see "Turning Off Your Computer" on page 139).
- 7 Turn off the monitor and disconnect it from the electrical outlet.
- 8 Disconnect the computer power cable from the electrical outlet, and press the power button to ground the system board.
- 9 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 10 Locate the 2-pin password jumper on the system board and attach the jumper plug to its pins to re-enable the password feature. For more information see "System Board Components" on page 27.
- 11 Replace the computer cover (see "Replacing the Computer Cover" on page 145).



**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.


- 12 Connect your computer and devices to electrical outlets, and turn them on.



**NOTE:** This procedure enables the password feature. When you enter the system setup program (see "System Setup" on page 75), both system and administrator password options appear as Not Set—meaning that the password feature is enabled but no password is assigned.

- 13 Assign a new system and/or setup password. See "Passwords" on page 64.

## Clearing CMOS Settings

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the **Product Information Guide**.

- 1 Follow the procedures in "Before You Begin" on page 139.
- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Reset the current CMOS settings:
  - a Locate the password and CMOS jumpers (RTCRST) on the system board (see "System Board Components" on page 27).
  - b Remove the password jumper plug from its pins.
  - c Place the password jumper plug on the RTCRST pins and wait approximately 5 seconds. **d** Remove the jumper plug from the RTCRST pins and place it back upon the password pins.
- 4 Replace the computer cover (see "Replacing the Computer Cover" on page 145).



**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

- 5 Connect your computer and devices to electrical outlets, and turn them on.

## Flashing the BIOS

The BIOS may require flashing when an update is available or when replacing the system board.

- 1 Turn on the computer.
- 2 Locate the BIOS update file for your computer at the Dell Support website at [support.dell.com](http://support.dell.com).
- 3 Click **Download Now** to download the file.
- 4 If the **Export Compliance Disclaimer** window appears, click **Yes, I Accept this Agreement**.  
The **File Download** window appears.

## Clearing Forgotten Passwords

- 5 Click **Save this program to disk**, and then click **OK**.

The **Save In** window appears.

- 6 Click the down arrow to view the **Save In** menu, select **Desktop**, and then click **Save**.

The file downloads to your desktop.


- 7 Click Close when the **Download Complete** window appears.

The file icon appears on your desktop and is titled the same as the downloaded BIOS update file.


- 8 Double-click the file icon on the desktop and follow the on-screen instructions.

# 8

## Cleaning Your Computer


 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

### Computer, Keyboard, and Monitor

 **CAUTION:** Before you clean your computer, disconnect the computer from the electrical outlet. Clean your computer with a soft cloth dampened with water. Do not use liquid or aerosol cleaners, which may contain flammable substances.


- Use a can of compressed air to remove dust from between the keys on the keyboard.

### Floppy Drive

 **NOTICE:** Do not attempt to clean drive heads with a swab. You might accidentally misalign the heads which prevents the drive from operating.


Clean your floppy drive using a commercially available cleaning kit. These kits contain pretreated floppy disks to remove contaminants that accumulate during normal operation.

### CDs and DVDs

 **NOTICE:** Always use compressed air to clean the lens in the optical drive, and follow the instructions that come with the compressed-air product. Never touch the lens in the drive.

If you notice problems, such as skipping, with the playback quality of your CDs or DVDs, try cleaning the disks.

- 1 Hold the disk by its outer edge. You can also touch the inside edge of the center hole.

 **NOTICE:** To avoid damaging the surface, do not wipe in a circular motion around the disk.

## Cleaning Your Computer

- 2 With a soft, lint-free cloth, gently wipe the bottom of the disk (the unlabeled side) in a straight line from the center to the outer edge of the disk.

For stubborn dirt, try using water or a diluted solution of water and mild soap. You can also purchase commercial products that clean disks and provide some protection from dust, fingerprints, and scratches. Cleaning products for CDs are also safe to use on DVDs.

## Cleaning Your Computer



# 9 Troubleshooting

## Solving Problems

Follow these tips when you troubleshoot your computer:

- If you added or removed a part before the problem started, review the installation procedures and ensure that the part is correctly installed.
- If a peripheral device does not work, ensure that the device is properly connected.
- If an error message appears on the screen, write down the exact message. This message may help support personnel diagnose and fix the problem(s).
- If an error message occurs in a program, see the program's documentation.



**NOTE:** The procedures in this document were written for the Windows default view, so they may not apply if you set your Dell™ computer to the Windows Classic view.

## Battery Problems



**CAUTION:** There is a danger of a new battery exploding if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

**REPLACE THE BATTERY** — If you have to repeatedly reset time and date information after turning on the computer, or if an incorrect time or date displays during start-up, replace the battery. If the battery still does not work properly, contact Dell (see "Contacting Dell" on page 287).

## Drive Problems




**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the **Product Information Guide**.

**ENSURE THAT MICROSOFT® WINDOWS® RECOGNIZES THE DRIVE — *Windows XP:***

- Click **Start** and click **My Computer**.

*Windows Vista™:*

- Click the Windows Vista Start button  and click **Computer**.

If the drive is not listed, perform a full scan with your antivirus software to check for and remove viruses. Viruses can sometimes prevent Windows from recognizing the drive.

**TEST THE DRIVE —**

- Insert another disc to eliminate the possibility that the original drive is defective.
- Insert a bootable floppy disk and restart the computer.

**CLEAN THE DRIVE OR DISK —** See "Cleaning Your Computer" on page 91.

**CHECK THE CABLE CONNECTIONS**

**RUN THE HARDWARE TROUBLESHOOTER —** See "Troubleshooting Software and Hardware Problems in the Microsoft® Windows® XP and Microsoft Windows Vista™ Operating Systems" on page 131.

**RUN THE DELL DIAGNOSTICS —** See "Dell Diagnostics" on page 123.

### Optical drive problems



**NOTE:** High-speed optical drive vibration is normal and may cause noise, which does not indicate a defect in the drive or the media.



**NOTE:** Because of different regions worldwide and different disc formats, not all DVD titles work in all DVD drives.

**ADJUST THE WINDOWS VOLUME CONTROL —**

- Click the speaker icon in the lower-right corner of your screen.
- Ensure that the volume is turned up by clicking the sidebar and dragging it up.
- Ensure that the sound is not muted by clicking any boxes that are checked.

### Problems writing to an optical drive

**CLOSE OTHER PROGRAMS —** The optical drive must receive a steady stream of data during the writing process. If the stream is interrupted, an error occurs. Try closing all programs before you write to the optical.

**TURN OFF STANDBY MODE IN WINDOWS BEFORE WRITING TO A DISK** — See "Power Management" on page 37 or search for the keyword *standby* in Windows Help and Support for information on power management modes.

## Hard drive problems

### RUN CHECK DISK —

*Windows XP:*

- 1 Click **Start** and click **My Computer**.
- 2 Right-click **Local Disk C:**.
- 3 Click **Properties** → **Tools** → **Check Now**.
- 4 Click **Scan for and attempt recovery of bad sectors and click Start**.

*Windows Vista:*

- 1 Click **Start**  and click **Computer**.
- 2 Right-click **Local Disk C:**.
- 3 Click **Properties** → **Tools** → **Check Now**.

The **User Account Control** window may appear. If you are an administrator on the computer, click **Continue**; otherwise, contact your administrator to continue the desired action.

- 4 Follow the instructions on the screen.

## E-Mail and Internet Problems



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

**CHECK THE MICROSOFT OUTLOOK<sup>®</sup> EXPRESS SECURITY SETTINGS** — If you cannot open your e-mail attachments:

- 1 In Outlook Express, click **Tools** → **Options** → **Security**.
- 2 Click **Do not allow attachments** to remove the checkmark, as needed.

**CHECK THE TELEPHONE LINE CONNECTION**

**CHECK THE TELEPHONE JACK**


**CONNECT THE MODEM DIRECTLY TO THE TELEPHONE WALL JACK**

**USE A DIFFERENT TELEPHONE LINE** —

- Verify that the telephone line is connected to the jack on the modem (the jack has either a green label or a connector-shaped icon next to it).
- Ensure that you hear a click when you insert the telephone line connector into the modem.

- Disconnect the telephone line from the modem and connect it to a telephone, then listen for a dial tone.
- If you have other telephone devices sharing the line, such as an answering machine, fax machine, surge protector, or line splitter, bypass them and use the telephone to connect the modem directly to the telephone wall jack. If you are using a line that is 3 meters (10 feet) or more in length, try a shorter one.

## Keyboard Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.


### CHECK THE KEYBOARD CABLE —

- Ensure that the keyboard cable is firmly connected to the computer.
- Shut down the computer, reconnect the keyboard cable as shown on the setup diagram for your computer, and then restart the computer.
- Ensure that the cable is not damaged or frayed and check cable connectors for bent or broken pins. Straighten any bent pins.
- Remove any keyboard extension cables and connect the keyboard directly to the computer.

**TEST THE KEYBOARD** — Connect a properly working keyboard to the computer, then try using the keyboard.

**RUN THE HARDWARE TROUBLESHOOTER** — See "Troubleshooting Software and Hardware Problems in the Microsoft® Windows® XP and Microsoft Windows Vista™ Operating Systems" on page 131.

## Lockups and Software Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

### The computer does not start up

**CHECK THE DIAGNOSTIC LIGHTS** — See "Diagnostic Lights" on page 105. **ENSURE THAT THE POWER CABLE IS FIRMLY CONNECTED TO THE COMPUTER AND TO THE ELECTRICAL OUTLET**

## The computer stops responding



**NOTICE:** You may lose data if you are unable to perform an operating system shutdown.

**TURN THE COMPUTER OFF** — If you are unable to get a response by pressing a key on your keyboard or moving your mouse, press and hold the power button for at least 8 to 10 seconds (until the computer turns off), and then restart your computer.

## A program stops responding

### END THE PROGRAM —

- 1 Press <Ctrl><Shift><Esc> simultaneously to access the Task Manager.
- 2 Click the **Applications** tab.
- 3 Click to select the program that is no longer responding. 4 Click **End Task**.

## A program crashes repeatedly



**NOTE:** Most software includes installation instructions in its documentation or on a floppy disk, CD, or DVD.

**CHECK THE SOFTWARE DOCUMENTATION** — If necessary, uninstall and then reinstall the program.

## A program is designed for an earlier Windows operating system


### RUN THE PROGRAM COMPATIBILITY WIZARD — *Windows XP:*

The Program Compatibility Wizard configures a program so that it runs in an environment similar to non-XP operating system environments.

- 1 Click **Start** → **All Programs** → **Accessories** → **Program Compatibility Wizard** → **Next**.
- 2 Follow the instructions on the screen.

*Windows Vista:*

The Program Compatibility Wizard configures a program so that it runs in an environment similar to non-Windows Vista operating system environments.

- 1 Click **Start**  → **Control Panel** → **Programs** → **Use an older program with this version of Windows**.
- 2 In the welcome screen, click **Next**.
- 3 Follow the instructions on the screen.

## **A solid blue screen appears**

**TURN THE COMPUTER OFF** — If you are unable to get a response by pressing a key on your keyboard or moving your mouse, press and hold the power button for at least 8 to 10 seconds (until the computer turns off), and then restart your computer.

## **Other software problems**

**CHECK THE SOFTWARE DOCUMENTATION OR CONTACT THE SOFTWARE MANUFACTURER FOR TROUBLESHOOTING INFORMATION** —

- Ensure that the program is compatible with the operating system installed on your computer.
- Ensure that your computer meets the minimum hardware requirements needed to run the software. See the software documentation for information.
- Ensure that the program is installed and configured properly.
- Verify that the device drivers do not conflict with the program.
- If necessary, uninstall and then reinstall the program.

**BACK UP YOUR FILES IMMEDIATELY**

**USE A VIRUS-SCANNING PROGRAM TO CHECK THE HARD DRIVE, FLOPPY DISKS, CDs, OR DVDs**

**SAVE AND CLOSE ANY OPEN FILES OR PROGRAMS AND SHUT DOWN YOUR COMPUTER THROUGH THE START MENU**

## **Memory Problems**



**CAUTION: Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.**

**IF YOU RECEIVE AN INSUFFICIENT MEMORY MESSAGE** —

- Save and close any open files and exit any open programs you are not using to see if that resolves the problem.
- See the software documentation for minimum memory requirements. If necessary, install additional memory (see "Memory Installation" on page 173).
- Reseat the memory modules (see "Memory" on page 172) to ensure that your computer is successfully communicating with the memory.
- Run the Dell Diagnostics (see "Dell Diagnostics" on page 123).

**IF YOU EXPERIENCE OTHER MEMORY PROBLEMS** —

- Reseat the memory modules (see "Memory" on page 172) to ensure that your computer is successfully communicating with the memory.

- Ensure that you are following the memory installation guidelines (see "Memory Installation" on page 173).
- Ensure that the memory you are using is supported by your computer. For more information about the type of memory supported by your computer, see "Memory" on page 172.
- Run the Dell Diagnostics (see "Dell Diagnostics" on page 123).

## Mouse Problems



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

### CHECK THE MOUSE CABLE —

- Ensure that the cable is not damaged or frayed and check cable connectors for bent or broken pins. Straighten any bent pins.
- Remove any mouse extension cables, and connect the mouse directly to the computer.
- Verify that the mouse cable is connected as shown on the setup diagram for your computer.

### RESTART THE COMPUTER —

- 1 Simultaneously press <Ctrl><Esc> to display the **Start** menu.
- 2 Press <u>, press the up- and down-arrow keys to highlight **Shut down** or **Turn Off**, and then press <Enter>.
- 3 After the computer turns off, reconnect the mouse cable as shown on the setup diagram.
- 4 Turn on the computer.

**TEST THE MOUSE** — Connect a properly working mouse to the computer, then try using the mouse.

### CHECK THE MOUSE SETTINGS — *Windows XP:*

- 1 Click **Start** → **Control Panel** → **Mouse**.
- 2 Adjust the settings as needed.


*Windows Vista:*

- 1 Click **Start**  → **Control Panel** → **Hardware and Sound** → **Mouse**.
- 2 Adjust the settings as needed.

**REINSTALL THE MOUSE DRIVER** — See "Drivers" on page 1295.

**RUN THE HARDWARE TROUBLESHOOTER** — See "Troubleshooting Software and Hardware Problems in the Microsoft® Windows® XP and Microsoft Windows Vista™ Operating Systems" on page 131.

## Network Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

**CHECK THE NETWORK CABLE CONNECTOR** — Ensure that the network cable is firmly inserted into the network connector on the back of the computer and the network jack.


**CHECK THE NETWORK LIGHTS ON THE BACK OF THE COMPUTER** — If the link integrity light is off (see "Controls and Lights" on page 32), no network communication is occurring. Replace the network cable.

**RESTART THE COMPUTER AND LOG ON TO THE NETWORK AGAIN**

**CHECK YOUR NETWORK SETTINGS** — Contact your network administrator or the person who set up your network to verify that your network settings are correct and that the network is functioning.

**RUN THE HARDWARE TROUBLESHOOTER** — See "Troubleshooting Software and Hardware Problems in the Microsoft® Windows® XP and Microsoft Windows Vista™ Operating Systems" on page 131.

## Power Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

**IF THE POWER LIGHT IS GREEN AND THE COMPUTER IS NOT RESPONDING** — See "Diagnostic Lights" on page 105.

**IF THE POWER LIGHT IS BLINKING GREEN** — The computer is in standby mode. Press a key on the keyboard, move the mouse, or press the power button to resume normal operation.

**IF THE POWER LIGHT IS OFF** — The computer is either turned off or is not receiving power.

- Reseat the power cable in the power connector on the back of the computer and the electrical outlet.
- Bypass power strips, power extension cables, and other power protection devices to verify that the computer turns on properly.
- Ensure that any power strips being used are plugged into an electrical outlet and are turned on.



- Ensure that the electrical outlet is working by testing it with another device, such as a lamp.
- Ensure that the main power cable and front panel cable are securely connected to the system board (see "System Board Components" on page 27).

**IF THE POWER LIGHT IS BLINKING AMBER** — The computer is receiving electrical power, but an internal power problem may exist.

- Ensure that the voltage selection switch is set to match the AC power at your location (if applicable).
- Ensure that all components and cables are properly installed and securely connected to the system board (see "System Board Components" on page 27).

**IF THE POWER LIGHT IS STEADY AMBER** — A device may be malfunctioning or incorrectly installed.

- Ensure that the processor power cable is securely connected to the system board power connector (POWER2) (see "System Board Components" on page 27).
- Remove and then reinstall all memory modules (see "Memory" on page 172).

**ELIMINATE INTERFERENCE** — Some possible causes of interference are:

- Power, keyboard, and mouse extension cables
- Too many devices connected to the same power strip
- Multiple power strips connected to the same electrical outlet

## Printer Problems



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.



**NOTE:** If you need technical assistance for your printer, contact the printer's manufacturer.

**CHECK THE PRINTER DOCUMENTATION** — See the printer documentation for setup and troubleshooting information.

**ENSURE THAT THE PRINTER IS TURNED ON**

**CHECK THE PRINTER CABLE CONNECTIONS** —


- See the printer documentation for cable connection information.
- Ensure that the printer cables are securely connected to the printer and the computer.

**TEST THE ELECTRICAL OUTLET** — Ensure that the electrical outlet is working by testing it with another device, such as a lamp.


**VERIFY THAT THE PRINTER IS RECOGNIZED BY WINDOWS — Windows XP:**


- 1 Click **Start** → **Control Panel** → **Printers and Other Hardware** → **View installed printers or fax printers**.
- 2 If the printer is listed, right-click the printer icon.
- 3 Click **Properties** → **Ports**. For a parallel printer, ensure that the **Print to the following port(s)**: setting is **LPT1 (Printer Port)**. For a USB printer, ensure that the **Print to the following port(s)**: setting is **USB**.

*Windows Vista:*

- 1 Click **Start**  → **Control Panel** → **Hardware and Sound** → **Printer**.
- 2 If the printer is listed, right-click the printer icon.
- 3 Click **Properties** and click **Ports**.
- 4 Adjust the settings, as needed.
- 5 Reinstall the printer driver. See the printer documentation for information on reinstalling the printer driver.

## Scanner Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

 **NOTE:** If you need technical assistance for your scanner, contact the scanner's manufacturer.

**CHECK THE SCANNER DOCUMENTATION** — See the scanner documentation for setup and troubleshooting information.

**UNLOCK THE SCANNER** — Ensure that your scanner is unlocked (if the scanner has a locking tab or button).

**RESTART THE COMPUTER AND TRY THE SCANNER AGAIN**


**CHECK THE CABLE CONNECTIONS** —

- See the scanner documentation for information on cable connections.
- Ensure that the scanner cables are securely connected to the scanner and the computer.

**VERIFY THAT THE SCANNER IS RECOGNIZED BY MICROSOFT WINDOWS — Windows XP:**

- 1 Click **Start** → **Control Panel** → **Printers and Other Hardware** → **Scanners and Cameras**.
- 2 If your scanner is listed, Windows recognizes the scanner.


*Windows Vista:*

1 Click **Start**  → **Control Panel** → **Hardware and Sound** → **Scanners and Cameras**.

2 If the scanner is listed, Windows recognizes the scanner.

**REINSTALL THE SCANNER DRIVER** — See the scanner documentation for instructions.

## Sound Problems

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

**ADJUST THE WINDOWS VOLUME CONTROL** — Click or double-click the speaker icon in the lower-right corner of your screen. Ensure that the volume is turned up and that the sound is not muted.

**TEST THE ELECTRICAL OUTLET** — Ensure that the electrical outlet is working by testing it with another device, such as a lamp.


**ELIMINATE POSSIBLE INTERFERENCE** — Turn off nearby fans, fluorescent lights, or halogen lamps to check for interference.

**REINSTALL THE SOUND DRIVER** — See "Drivers" on page 129.

**RUN THE HARDWARE TROUBLESHOOTER** — See "Troubleshooting Software and Hardware Problems in the Microsoft® Windows® XP and Microsoft Windows Vista™ Operating Systems" on page 131.





# 10 Troubleshooting Tools

## Diagnostic Lights







 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.



To help you troubleshoot a problem, your computer has four lights labeled "1," "2," "3," and "4" on the front. The lights can be "off" or green. When the computer starts normally, the lights flash. If the computer malfunctions, the pattern of the lights and also that of the power button help to identify the problem. These lights also indicate sleep states.





### Diagnostic Light Codes Before POST

Diagnostic Lights	Power Light	Problem Description	Suggested Resolution
   	off	The computer is in a off condition or in Windows Hibernation mode.	Press the power button to normal turn the computer on.  If the computer does not turn on, ensure that the front-panel power light is on. If the power light is off, ensure that the computer is connected to a working electrical outlet and then press the power button.  If the problem is still not resolved, contact Dell for technical assistance (see "Contacting Dell" on page 287).

Light	Power	Problem	Description
4	blinking or	The computer is in a "sleep" state.	Use one of the appropriate green computer. See "Advanced Features" on page 35. If the problem is not resolved and you are trying to wake the computer with a USB mouse or keyboard, substitute the mouse or keyboard with a working PS/2 mouse or keyboard and then try to wake the computer.
4	green	None.	The system hardware appears to be operating normally. Any issues seen may be related to the operating system or software. Ensure that the processor is seated correctly and restart the computer (see "Processor" on page 150). If the problem is still not resolved, contact Dell for technical assistance (see "Contacting Dell" on page 287).
(blinking)	amber	The BIOS is not executing.	blinking A possible power Perform the procedure in amber supply or power cable "Power Problems" on
1 2 3 4	failure has occurred.	page 100. If the problem is still not resolved, contact Dell for technical assistance (see "Contacting Dell" on page 287).	







<b>Diagnostic Lights</b>	<b>Power Light</b>	<b>Problem Description</b>	<b>Suggested Resolution</b>
	amber	A problem has been	<p>(blinking) graphics riser.</p> <p>Confirm that the memory risers and/or graphics riser are properly seated into the</p> <p>Confirm that the power cables are properly attached to the memory risers and graphics riser.</p> <p>See "Memory" on page 172 for further information.</p> <p>If the problem is still not resolved, contact Dell for technical assistance (see "Contacting Dell" on page 287).</p>
	amber	A possible system board failure has occurred.	Contact Dell for technical assistance (see "Contacting Dell" on page 287).
	amber	A possible system board failure has occurred.	Contact Dell for technical assistance (see "Contacting Dell" on page 287).
	amber	A possible system board failure has occurred.	Contact Dell for technical assistance (see "Contacting Dell" on page 287).
	amber	detected with either the memory risers or A possible system board failure has occurred.	<p>correct connector.</p> <p>Contact Dell for technical assistance (see "Contacting Dell" on page 287).</p>
<b>Diagnostic Lights</b>	<b>Power Light</b>	<b>Problem Description</b>	
	amber	A processor mismatch	See "Troubleshooting" on

Light Pattern	Problem Description	Suggested Resolution
  (blinking)	exists.	1 page 93 and then to "Processor" on page 150.

    (blinking)	amber Power supply cables not properly in to the motherboard.	Verify that both power supply cables are plugged connected.
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### Diagnostic Light Codes During POST

The power light displays a solid green for diagnostic light codes during POST.

Light Pattern	Problem Description	Suggested Resolution
   	A possible processor failure has occurred.	Reinstall the processor (see "Processor" on page 150) and restart the computer.
 	A possible expansion card failure has occurred.  <b>2</b> If the problem persists, reinstall the card that you removed, remove a different card, and then restart the computer.  <b>3</b> Repeat this process for each card. If the computer starts normally, troubleshoot the last card removed from the computer for resource conflicts (see	Determine if a conflict exists by removing a card (not the graphics card) and then restarting the computer (see "Cards" on page 194).





"Troubleshooting Software and Hardware Problems in the Microsoft® Windows® XP and Microsoft Windows Vista™ Operating Systems" on page 131).







**4** If the problem persists, contact Dell for technical assistance (see "Contacting Dell" on page 287).

Light Pattern	Problem Description	Suggested Resolution
	<p>A possible graphics card failure has occurred.</p>	<p><b>1</b> If the computer has a graphics card, remove the</p>
	<p>A possible floppy or hard drive failure has occurred.</p> <p>card, reinstall it, and then restart the computer (see "Cards" on page 194).</p>	<p><b>3</b> If the problem persists or the computer has integrated graphics, <del>contact Dell for technical assistance</del> (see "Contacting Dell" on page 287).</p>
	<p><b>2</b> If the problem still exists, install a graphics card that you know works and restart the computer.</p>	<p>Reseat all power and data cables and restart the</p>
<p>A possible USB failure has occurred.</p> <p>computer.</p>	<p>Reinstall all USB devices, check cable connections, and then restart the computer.</p>	<p>Reseat the memory modules to ensure that your computer is successfully communicating with the memory (see "Memory" on page 172).</p>
	<p>No memory modules are detected.</p>	<p><b>2</b> Restart the computer.</p> <p><b>3</b> If the problem still exists, remove all the memory</p>




Light Pattern	Problem Description	Suggested Resolution
<p>①</p>	<p>④</p> <p>modules and install one memory module in memory module connector DIMM_1.</p> <p><b>4</b> Restart the computer.</p> <p>A message appears stating that because your memory is not paired, the system will operate with reduced performance and reduced error-correction capability.</p> <p><b>5</b> Press &lt;F1&gt; to boot to the operating system.</p> <p><b>6</b> Run the Dell Diagnostics (see "Dell Diagnostics" on page 123).</p> <p><b>7</b> If the memory module passes, shut down the computer (see "Turning Off Your Computer" on page 139), remove the memory module, and then repeat the process with the remaining memory modules until a memory error occurs during start-up or diagnostic testing.</p>	<p>1</p>

Error	Problem Description	Suggested Resolution
		<p>If the first memory module tested is defective, repeat the process with the remaining modules to ensure that the remaining modules are not defective.</p> <p><b>8</b> When the defective memory module is identified, contact Dell for a replacement (see "Contacting Dell" on page 287).</p>
	System board failure has occurred.	Contact Dell for technical assistance (see "Contacting Dell" on page 287).
	Memory modules are detected, or memory module/memory compatibility error exists.	<ul style="list-style-type: none"> <li>• Ensure that no special but a memory configuration connector placement requirements exist (see "Memory" on page 172).</li> <li>• Verify that the memory modules that you are installing are compatible with your computer (see "Memory" on page 172).</li> <li>• Reinstall the memory modules and restart the computer.</li> <li>• If the problem persists, contact Dell (see "Contacting Dell" on page 287)</li> </ul>
	Routine system activity screen messages.	Watch your monitor for onpreceding video initialization.
		<p>A possible expansion card failure has occurred.</p> <p>Determine if a conflict exists by removing a card</p>

Light Pattern	Problem Description	Suggested Resolution
 		<p><b>1</b></p> <p>(not a graphics card) and restarting the computer (see "Cards" on page 194).</p> <p><b>2</b> If the problem persists, reinstall the card that you removed, remove a different card, and then restart the computer.</p> <p><b>3</b> Repeat this process for each card. If the computer starts normally, troubleshoot the last card removed from the computer for resource conflicts (see "Troubleshooting Software and Hardware Problems in the Microsoft® Windows® XP and Microsoft Windows Vista™ Operating Systems" on page 131).</p> <p><b>4</b> If the problem persists, contact Dell (see "Contacting Dell" on page 287).</p>
   	<p>Routine system activity preceding video initialization.</p>	<p>Watch your monitor for on-screen messages.</p>

## Power Lights

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

The power button light (bi-color LED) located on the front of the computer illuminates and blinks or remains solid to indicate different states:

- If the power light is off, the computer is either turned off or is not receiving power.
  - Reseat the power cable in the power connector on the back of the computer and the electrical outlet.
  - If the computer is plugged into a power strip, ensure that the power strip is plugged into an electrical outlet and that the power strip is turned on. Also, bypass power protection devices, power strips, and power extension cables to verify that the computer turns on properly.
  - Ensure that the electrical outlet is working by testing it with another device, such as a lamp.
- If the power light is steady blue and the computer is not responding:
  - Ensure that the display is connected and powered on.
  - If the display is connected and powered on, see "Beep Codes" on page 115.
- If the power light is blinking blue, the computer is in standby mode. Press a key on the keyboard, move the mouse, or press the power button to resume normal operation. If the power light is blue and the computer is not responding:
  - Ensure the display is connected and powered on.
  - If the display is connected and powered on, see "Beep Codes" on page 115.
- If the power light is blinking amber, the computer is receiving electrical power, but a device might be malfunctioning or incorrectly installed.
  - Remove and then reinstall the memory modules (see "Memory" on page 172).
  - Remove and then reinstall any cards.
  - Remove and then reinstall the graphics card, if applicable.
- If the power light is steady amber, there may be a power problem or an internal device malfunction.
  - Ensure that all power cables are securely connected to the system board (see "System Board Components" on page 27).

- Ensure that the main power cable and front panel cable are securely connected to the system board (see "System Board Components" on page 27).

## Beep Codes

Your computer might emit a series of beeps during start-up if the monitor cannot display errors or problems. This series of beeps, called a beep code, identifies a problem. One possible beep code (code 1-3-1) consists of one beep, a burst of three beeps, and then one beep. This beep code tells you that the computer encountered a memory problem.

If your computer beeps during start-up:

- 1 Write down the beep code on the "Diagnostics Checklist" on page 286.
- 2 Run the Dell Diagnostics to identify a more serious cause (see "Dell Diagnostics" on page 123).
- 3 Contact Dell for technical assistance (see "Contacting Dell" on page 287).

Code	Cause
1-1-2	Microprocessor register failure
1-1-3	NVRAM read/write failure
1-1-4	ROM BIOS checksum failure
1-2-1	Programmable interval timer failure
1-2-2	DMA initialization failure
1-2-3	DMA page register read/write failure
1-3	Video Memory Test failure
1-3-1	through 2-4- Memory not being properly identified or used 4
1-3-2	Memory problem
3-1-1	Slave DMA register failure
3-1-2	Master DMA register failure
3-1-3	Master interrupt mask register failure

Code	Cause
3-2-2	Interrupt vector loading failure
3-2-4	Keyboard Controller Test failure
3-3-1	NVRAM power loss
3-3-2	Invalid NVRAM configuration
3-3-4	Video Memory Test failure
3-4-1	Screen initialization failure
3-4-2	Screen retrace failure
3-4-3	Search for video ROM failure
4-2-1	No timer tick
4-2-2	Shutdown failure
4-2-3	Gate A20 failure
4-2-4	Unexpected interrupt in protected mode
4-3-1	Memory failure above address 0FFFFh
4-3-3	Timer-chip counter 2 failure
4-3-4	Time-of-day clock stopped
4-4-1	Serial or parallel port test failure
4-4-2	Failure to decompress code to shadowed memory
4-4-3	Math-coprocessor test failure
4-4-4	Cache test failure

## Error Messages

Fill out the "Diagnostics Checklist" on page 286 as you complete these checks.



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

If the message is not listed, see the documentation for the operating system or the program that was running when the message appeared.

**A FILENAME CANNOT CONTAIN ANY OF THE FOLLOWING CHARACTERS: \ / : \* ? " < > |** — Do not use these characters in filenames.

**A REQUIRED .DLL FILE WAS NOT FOUND** — The program that you are trying to open is missing an essential file. To remove and then reinstall the program:

- 1 Click the **Start** button, click **Control Panel**, and then click **Add or Remove Programs**.
- 2 Select the program you want to remove.
- 3 Click the **Change or Remove Program** icon.
- 4 See the program documentation for installation instructions.

**ALERT! AIR TEMPERATURE SENSOR NOT DETECTED.** — Ensure that all cables are securely fastened to the I/O panel and to the system board and reboot your computer. If this does not resolve the problem, contact Dell. (See "Contacting Dell" on page 259.)

**ALERT! CPU INSTALLED IN INCORRECT SOCKET** —

**ALERT! SYSTEM THERMAL SOLUTION COMPROMISED. REPLACE SYSTEM COVER AND REBOOT** — Ensure that the computer cover is correctly installed, then restart your computer.

**NOTE:** Single processor configurations must use CPU\_0.

**ALERT! PREVIOUS ATTEMPTS AT BOOTING THIS SYSTEM HAVE FAILED AT CHECKPOINT [NNNN]. FOR HELP IN RESOLVING THIS PROBLEM, PLEASE NOTE THIS CHECKPOINT AND CONTACT DELL TECHNICAL SUPPORT** — Contact Dell

and report the checkpoint code (*nnnn*) to the support technician. (See "Contacting Dell" on page 287.)

**ALERT! MEMORY FAN FAILURE — ALERT! HARD**

**DRIVE FAN FAILURE —**

**ALERT! FRONT FAN FAILURE —**

**ALERT! CHIPSET HEATSINK NOT DETECTED. —**

**ALERT! CARD CAGE FAN FAILURE — ALERT! POWER**

**SUPPLY FAN FAILURE —**

**ALERT! PREVIOUS FAN FAILURES — ALERT! PREVIOUS**

**THERMAL FAILURE —**

**ALERT! PREVIOUS SHUTDOWN DUE TO THERMAL EVENT —** Ensure that nothing is blocking the airflow vents and that all the fans are properly installed and operating correctly. Also, ensure that the processor heat-sink assembly is properly installed.

**ALERT! PREVIOUS REBOOT WAS DUE TO VOLTAGE REGULATOR FAILURE —**

Contact Dell for assistance. See "Contacting Dell" on page 287.

**ALERT! SYSTEM BATTERY VOLTAGE IS LOW —** Replace the battery. See "Replacing the Battery" on page 171.

**ALERT! MEMORY CONFIGURATION MISMATCH. PLEASE ENTER SETUP FOR MEMORY INFORMATION DETAILS. —**

**ALERT! MEMORY RISERS MUST BE INSTALLED AS A SET OF FOUR —**

**ALERT! UNCORRECTABLE MEMORY ERROR PREVIOUSLY DETECTED IN DIMM\_X/Y —**

**ALERT! OPERATING IN SINGLE CHANNEL DEBUG MODE. PLEASE POPULATE MEMORY IN MATCHED SETS FOR NORMAL OPERATION. —**

**ALERT! MEMORY BUILT-IN SELF TEST FAILS IN DIMM\_X/Y —** See "Memory Problems" on page 98.

**ALERT! INVALID MEMORY INSTALLED. DIMMs MUST HAVE FULL DIMM HEAT SPREADERS —** Ensure that you are using or have installed the full-length heat spreaders correctly.



**ATTACHMENT FAILED TO RESPOND** — See "Drive Problems" on page 93.

**BAD COMMAND OR FILE NAME** — Ensure that you spelled the command correctly, put spaces in the proper place, and used the correct path name.

**BAD ERROR-CORRECTION CODE (ECC) ON DISK READ** — See "Drive Problems" on page 93.

**CONTROLLER HAS FAILED** — See "Drive Problems" on page 93.

**DATA ERROR** — See "Drive Problems" on page 93.

**DECREASING AVAILABLE MEMORY** — See "Lockups and Software Problems" on page 96.

**DISKETTE DRIVE 0 SEEK FAILURE** — See "Drive Problems" on page 93.

**DISKETTE READ FAILURE** — See "Drive Problems" on page 93.

**DISKETTE SUBSYSTEM RESET FAILED** — Run the Dell Diagnostics. See "Dell Diagnostics" on page 123.

**DISKETTE WRITE PROTECTED** — Slide the write-protect notch to the open position.

**DRIVE NOT READY** — Put a floppy disk in the drive.

**GATE A20 FAILURE** — See "Lockups and Software Problems" on page 96.

**HARD-DISK CONFIGURATION ERROR** —

**HARD-DISK CONTROLLER FAILURE** —

**HARD-DISK DRIVE FAILURE** —

**HARD-DISK DRIVE FAILURE** — See "Drive Problems" on page 93.

**INSERT BOOTABLE MEDIA** — Insert a bootable floppy disk, CD, or other bootable media.

**INVALID CONFIGURATION INFORMATION - PLEASE RUN SETUP PROGRAM** —

Enter system setup (see "System Setup" on page 75) and correct the computer configuration information.

**KEYBOARD FAILURE** — See "Keyboard Problems" on page 96

**MEMORY ADDRESS LINE FAILURE AT address, READ value EXPECTING value** — See "Memory Problems" on page 98.

**MEMORY ALLOCATION ERROR** —

- 1 Turn off the computer, wait 30 seconds, and then restart the computer.
- 2 Try to run the program again.
- 3 If the error message appears again, see the software documentation for additional troubleshooting suggestions.

**MEMORY DATA LINE FAILURE AT address, READ value EXPECTING value** —

**MEMORY DOUBLE WORD LOGIC FAILURE AT address, READ value EXPECTING value** —

**MEMORY ODD/EVEN LOGIC FAILURE AT address, READ value EXPECTING value** —

**MEMORY WRITE/READ FAILURE AT address, READ value EXPECTING value** —

**MEMORY SIZE IN CMOS INVALID** — See "Memory Problems" on page 98.

**NO BOOT DEVICE AVAILABLE** —

- If the floppy drive is your boot device, ensure that bootable media is in the drive.
- If the hard drive is your boot device, ensure that the cables are connected and that the drive is installed properly and partitioned as a boot device.
- Enter system setup (see "System Setup" on page 75) and ensure that the boot sequence information is correct.

**NO BOOT SECTOR ON HARD-DISK DRIVE** — Enter system setup (see "System Setup" on page 75) and ensure that the computer configuration information for the hard drive is correct.

If the message continues to appear after you ensure that the information in system setup is correct, see your operating system documentation for reinstallation information.

**NO TIMER TICK INTERRUPT** — Run the Dell Diagnostics. See "Dell Diagnostics" on page 123.

**NON-SYSTEM DISK OR DISK ERROR** — Replace the floppy disk with one that has a bootable operating system or remove the floppy disk from drive A and restart the computer.

**NOT A BOOT DISKETTE** — Insert bootable media and restart your computer.

**NOT ENOUGH MEMORY OR RESOURCES. CLOSE SOME PROGRAMS AND TRY AGAIN** — Close all windows and open the program that you want to use. In some cases, you might have to restart your computer to restore computer resources. If so, run the program that you want to use first.

**OPERATING SYSTEM NOT FOUND** — Contact Dell (see "Contacting Dell" on page 287).

**PLEASE CONNECT USB KEYBOARD/MOUSE TO USB PORTS ON THE BACK OF**

**THE COMPUTER** — Turn your computer off, connect the USB keyboard and/or mouse to the USB connectors on the back of the computer, and then restart your computer.

**PLUG AND PLAY CONFIGURATION ERROR** —

- 1 Turn your computer off, unplug it from the electrical outlet, and then remove all but one of the cards.
- 2 Plug in your computer and reboot it.
- 3 If the message reappears, the installed card might be malfunctioning. If the message does not reappear, turn off the computer and reinsert one of the other cards.
- 4 Repeat this process until you identify which card is malfunctioning.

**READ FAULT** —

**REQUESTED SECTOR NOT FOUND** —

**RESET FAILED** —

See "Drive Problems" on page 93.

**SECTOR NOT FOUND** —

- Run the Windows error-checking utility to check the file structure on the floppy disk or hard drive. See Windows Help for instructions.
- If a large number of sectors are defective, back up the data (if possible), and then reformat the floppy disk or hard drive.

**SEEK ERROR** — See "Drive Problems" on page 93.

**SHUTDOWN FAILURE** — Run the Dell Diagnostics. See "Dell Diagnostics" on page 123.

**TIME-OF-DAY CLOCK STOPPED** —

**TIME-OF-DAY NOT SET** —

Enter system setup (see "System Setup" on page 75) and correct the date or time. If the problem persists, replace the battery (see "Battery" on page 169).

**TIMER CHIP COUNTER 2 FAILED** — Run the Dell Diagnostics. See "Dell Diagnostics" on page 123.

**UNEXPECTED INTERRUPT IN PROTECTED MODE** See "Dell Diagnostics" on page 123. — Run the Dell Diagnostics.

**WARNING: DELL'S DISK MONITORING SYSTEM HAS DETECTED THAT DRIVE [0/1] ON THE IDE CONTROLLER IS OPERATING OUTSIDE OF NORMAL**


**SPECIFICATIONS. IT IS ADVISABLE TO IMMEDIATELY BACK UP YOUR DATA AND REPLACE YOUR HARD DRIVE BY CALLING YOUR SUPPORT DESK OR DELL** — If no replacement drive is immediately available and the drive is not the only bootable drive, enter system setup and change the appropriate drive setting to **None** (see "System Setup" on page 75). Then remove the drive from the computer.

**WRITE FAULT** —

**WRITE FAULT ON SELECTED DRIVE** — See "Drive Problems" on page 93.

**<drive letter>:\ IS NOT ACCESSIBLE. THE DEVICE IS NOT READY** — The floppy drive cannot read the disk. Insert a floppy disk into the drive and try again.

## Dell Diagnostics

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

### When to Use the Dell Diagnostics

If you experience a problem with your computer, perform the checks in "Lockups and Software Problems" on page 96 and run the Dell Diagnostics before you contact Dell for technical assistance.

It is recommended that you print these procedures before you begin.



**NOTICE:** The Dell Diagnostics works only on Dell™ computers.

**NOTE:** The *Drivers and Utilities* media is optional and may not ship with your computer.

Enter system setup (see "System Setup" on page 75), review your computer's configuration information, and ensure that the device you want to test displays in system setup and is active.

Start the Dell Diagnostics from either your hard drive or from the *Drivers and Utilities* media.

### Starting the Dell Diagnostics From Your Hard Drive

- 1 Turn on (or restart) your computer.
- 2 When the DELL™ logo appears, press <F12> immediately.



**NOTE:** If you see a message stating that no diagnostics utility partition has been found, run the Dell Diagnostics from your *Drivers and Utilities* media. See "Starting the Dell Diagnostics From the Drivers and Utilities Media" on page 124.

If you wait too long and the operating system logo appears, continue to wait until you see the Microsoft® Windows® desktop. Then shut down your computer (see "Turning Off Your Computer" on page 139), and try again.


- 3 When the boot device list appears, highlight **Boot to Utility Partition** and press <Enter>.
- 4 When the Dell Diagnostics **Main Menu** appears (see "Dell Diagnostics Main Menu" on page 125), select the test that you want to run.

### Starting the Dell Diagnostics From the Drivers and Utilities Media

- 1 Insert the *Drivers and Utilities* media.
- 2 Shut down and restart the computer.

When the DELL logo appears, press <F12> immediately.

If you wait too long and the Windows logo appears, continue to wait until you see the Windows desktop. Then shut down your computer and try again.

 **NOTE:** The next steps change the boot sequence for one time only. On the next start-up, the computer boots according to the devices specified in the system setup program.

- 3 When the boot device list appears, highlight **Onboard or USB CD-ROM Drive** and press <Enter>.
- 4 Select the **Boot from CD-ROM** option from the menu that appears and press <Enter>.
- 5 Type 1 to start the menu and press <Enter> to proceed.
- 6 Select **Run the 32 Bit Dell Diagnostics** from the numbered list. If multiple versions are listed, select the version appropriate for your computer.
- 7 When the Dell Diagnostics **Main Menu** appears, select the test you want to run.


## Dell Diagnostics Main Menu

- 1 After the Dell Diagnostics loads and the **Main Menu** screen appears, click the button for the option you want.

Option	Function
Express Test	Performs a quick test of devices. This test typically takes 10 to 20 minutes and requires no interaction on your part. Run <b>Express Test</b> first to increase the possibility of tracing the problem quickly.
Extended Test	Performs a thorough check of devices. This test typically takes 1 hour or more and requires you to answer questions periodically.
Custom Test	Tests a specific device. You can customize the tests you want to run.
Symptom Tree	Lists the most common symptoms encountered and allows you to select a test based on the symptom of the problem you are having.

- 2 If a problem is encountered during a test, a message appears with an error code and a description of the problem. Write down the error code and problem description and follow the instructions on the screen.

If you cannot resolve the error condition, contact Dell (see "Contacting Dell" on page 287).

 **NOTE:** The Service Tag for your computer is located at the top of each test screen. If you contact Dell, technical support will ask for your Service Tag.

- 3 If you run a test from the **Custom Test** or **Symptom Tree** option, click the applicable tab described in the following table for more information.

Tab	Function
Results	Displays the results of the test and any error conditions encountered.
Errors	Displays error conditions encountered, error codes, and the problem description.
Help	Describes the test and may indicate requirements for running the test.
Configuration	Displays your hardware configuration for the selected device.  The Dell Diagnostics obtains configuration information for all devices from system setup, memory, and various internal tests, and it displays the information in the device list in the left pane of the screen. The device list may not display the names of all the components installed on your computer or all devices attached to your computer.
Parameters	Allows you to customize the test by changing the test settings.

- 4 When the tests are completed, if you are running the Dell Diagnostics from the *Drivers and Utilities* media, remove the disc.
- 5 Close the test screen to return to the **Main Menu** screen. To exit the Dell Diagnostics and restart the computer, close the **Main Menu** screen.

**Diagnostics Checklist Name:**

Date:

Address:



Phone number:

Service Tag (bar code on the back of the computer):

Express Service Code:

Return Material Authorization Number (if provided by Dell support technician):

Operating system and version:

Devices:

Expansion cards:

Are you connected to a network? Yes No Network,

version, and network adapter:

Programs and versions:

See your operating system documentation to determine the contents of the system's start-up files. If the computer is connected to a printer, print each file. Otherwise, record the contents of each file before calling Dell.

Error message, beep code, or diagnostic code:

Description of problem and troubleshooting procedures you performed:

# 11 Reinstalling Software

## Drivers

### What Is a Driver?

A driver is a program that controls a device such as a printer, mouse, or keyboard. All devices require a driver program.

A driver acts like a translator between the device and any other programs that use the device. Each device has its own set of specialized commands that only its driver recognizes.

Dell ships your computer to you with required drivers already installed—no further installation or configuration is needed.



**NOTICE:** The *Drivers and Utilities* disc may contain drivers for operating systems that are not on your computer. Ensure that you are installing software appropriate for your operating system.

Many drivers, such as the keyboard driver, come with your Microsoft Windows operating system. You may need to install drivers if you:

- Upgrade your operating system.
- Reinstall your operating system.
- Connect or install a new device.

### Identifying Drivers


If you experience a problem with any device, identify whether the driver is the source of your problem and, if necessary, update the driver.

#### Microsoft® Windows® XP

- 1 Click **Start** → **Control Panel**.

- 2 Under **Pick a Category**, click **Performance and Maintenance**, and click **System**.
- 3 In the **System Properties** window, click the **Hardware** tab, and click **Device Manager**.

### Microsoft Windows Vista™

- 1 Click the Windows Vista start button , and right-click **Computer**.
- 2 Click **Properties** → **Device Manager**.




**NOTE:** The User Account Control window may appear. If you are an administrator on the computer, click Continue; otherwise, contact your administrator to continue.

Scroll down the list to see if any device has an exclamation point (a yellow circle with a [!]) on the device icon.

If an exclamation point is next to the device name, you may need to reinstall the driver or install a new driver (see "Reinstalling Drivers and Utilities" on page 130).

### Reinstalling Drivers and Utilities

- 1  **NOTICE:** The Dell Support website at [support.dell.com](http://support.dell.com) and your *Drivers and Utilities* disc provide approved drivers for Dell™ computers. If you install drivers obtained from other sources, your computer might not work correctly.


### Using Windows Device Driver Rollback

If a problem occurs on your computer after you install or update a driver, use Windows Device Driver Rollback to replace the driver with the previously installed version.

*Windows XP:*

- 1 Click **Start** → **My Computer** → **Properties** → **Hardware** → **Device Manager**.
- 2 Right-click the device for which the new driver was installed and click **Properties**.
- 3 Click the **Drivers** tab → **Roll Back Driver**.

*Windows Vista:*

- 1 Click the Windows Vista start button , and right-click **Computer**.

- 2 Click **Properties**→ **Device Manager**.



**NOTE:** The User Account Control window may appear. If you are an administrator on the computer, click Continue; otherwise, contact your administrator to enter the Device Manager.

- 3 Right-click the device for which the new driver was installed and click **Properties**.
- 4 Click the **Drivers** tab→ **Roll Back Driver**.

If Device Driver Rollback does not resolve the problem, then use System Restore (see "Restoring Your Operating System" on page 132) to return your computer to the operating state that existed before you installed the new driver.

## Troubleshooting Software and Hardware

### Problems in the Microsoft® Windows® XP and Microsoft Windows Vista™ Operating Systems


If a device is either not detected during the operating system setup or is detected but incorrectly configured, you can use the Hardware Troubleshooter to resolve the incompatibility.

To start the Hardware Troubleshooter:

*Windows XP:*

- 1 Click **Start**→ **Help and Support**.
- 2 Type `hardware troubleshooter` in the search field and press <Enter> to start the search.
- 3 In the **Fix a Problem** section, click **Hardware Troubleshooter**.
- 4 In the **Hardware Troubleshooter** list, select the option that best describes the problem and click **Next** to follow the remaining troubleshooting steps.

*Windows Vista:*

- 1 Click the Windows Vista start button , and click **Help and Support**.
- 2 Type `hardware troubleshooter` in the search field and press <Enter> to start the search.

- 3 In the search results, select the option that best describes the problem and follow the remaining troubleshooting steps.

## Restoring Your Operating System

You can restore your operating system in the following ways:

- System Restore returns your computer to an earlier operating state without affecting data files. Use System Restore as the first solution for restoring your operating system and preserving data files.
- Dell PC Restore by Symantec (available in Windows XP) and Dell Factory Image Restore (available in Windows Vista) returns your hard drive to the operating state it was in when you purchased the computer. Both permanently delete all data on the hard drive and remove any programs installed after you received the computer. Use Dell PC Restore or Dell Factory Image Restore only if System Restore did not resolve your operating system problem.
- If you received an *Operating System* disc with your computer, you can use it to restore your operating system. However, using the *Operating System* disc also deletes all data on the hard drive. Use the disc *only* if System Restore did not resolve your operating system problem.

### Using Microsoft Windows System Restore

The Windows operating systems provide a System Restore option which allows you to return your computer to an earlier operating state (without affecting data files) if changes to the hardware, software, or other system settings have left the computer in an undesirable operating state. Any changes that System Restore makes to your computer are completely reversible.




**NOTICE:** Make regular backups of your data files. System Restore does not monitor your data files or recover them.



**NOTE:** The procedures in this document were written for the Windows default view, so they may not apply if you set your Dell™ computer to the Windows Classic view.



### Starting System Restore *Windows*

*XP:*

 **NOTICE:** Before you restore the computer to an earlier operating state, save and close any open files and exit any open programs. Do not alter, open, or delete any files or programs until the system restoration is complete.


- 1 Click **Start** → **All Programs** → **Accessories** → **System Tools** → **System Restore**.
- 2 Click either **Restore my computer to an earlier time** or **Create a restore point**.
- 3 Click **Next** and follow the remaining on-screen prompts.

*Windows Vista:*

- 1 Click **Start** .
- 2 In the Start Search box, type `System Restore` and press <Enter>.  
 **NOTE:** The User Account Control window may appear. If you are an administrator on the computer, click Continue; otherwise, contact your administrator to continue the desired action.
- 3 Click **Next** and follow the remaining prompts on the screen.

In the event that System Restore did not resolve the issue, you may undo the last system restore.


### Undoing the Last System Restore

 **NOTICE:** Before you undo the last system restore, save and close all open files and exit any open programs. Do not alter, open, or delete any files or programs until the system restoration is complete.

*Windows XP:*

- 1 Click **Start** → **All Programs** → **Accessories** → **System Tools** → **System Restore**.
- 2 Click **Undo my last restoration** and click **Next**.

*Windows Vista:*

- 1 Click **Start** .
- 2 In the Start Search box, type `System Restore` and press <Enter>.
- 3 Click **Undo my last restoration** and click **Next**.

## Enabling System Restore



**NOTE:** Windows Vista does not disable System Restore; regardless of low disk space. Therefore, the steps below apply only to Windows XP.

If you reinstall Windows XP with less than 200 MB of free hard-disk space available, System Restore is automatically disabled.

To see if System Restore is enabled:

- 1 Click **Start** → **Control Panel** → **Performance and Maintenance** → **System**.
- 2 Click the **System Restore** tab and ensure that **Turn off System Restore** is unchecked.

## Using Dell™ PC Restore and Dell Factory Image Restore



**NOTICE:** Using Dell PC Restore or Dell Factory Image Restore permanently deletes all data on the hard drive and removes any programs or drivers installed after you received your computer. If possible, back up the data before using these options. Use PC Restore or Dell Factory Image Restore only if System Restore did not resolve your operating system problem.



**NOTE:** Dell PC Restore by Symantec and Dell Factory Image Restore may not be available in certain countries or on certain computers.

Use Dell PC Restore (Windows XP) or Dell Factory Image Restore (Windows Vista) only as the last method to restore your operating system. These options restore your hard drive to the operating state it was in when you purchased the computer. Any programs or files added since you received your computer—including data files—are permanently deleted from the hard drive. Data files include documents, spreadsheets, e-mail messages, digital photos, music files, and so on. If possible, back up all data before using PC Restore or Factory Image Restore.

### Windows XP: Dell PC Restore Using

PC Restore:

- 1 Turn on the computer.  
During the boot process, a blue bar with **www.dell.com** appears at the top of the screen.
- 2 Immediately upon seeing the blue bar, press <Ctrl><F11>.

If you do not press <Ctrl><F11> in time, let the computer finish starting, and then restart the computer again.



**NOTICE:** If you do not want to proceed with PC Restore, click Reboot.

- 3 Click **Restore** and click **Confirm**.

The restore process takes approximately 6 to 10 minutes to complete.

- 4 When prompted, click **Finish** to reboot the computer.



**NOTE:** Do not manually shut down the computer. Click Finish and let the computer completely reboot.

- 5 When prompted, click **Yes**.

The computer restarts. Because the computer is restored to its original operating state, the screens that appear, such as the End User License Agreement, are the same ones that appeared the first time the computer was turned on.

- 6 Click **Next**.

The **System Restore** screen appears and the computer restarts.

- 7 After the computer restarts, click **OK**.

Removing PC Restore:



**NOTICE:** Removing Dell PC Restore from the hard drive permanently deletes the PC Restore utility from your computer. After you have removed Dell PC Restore, you will not be able to use it to restore your computer operating system.

Dell PC Restore enables you to restore your hard drive to the operating state it was in when you purchased your computer. It is recommended that you *do not* remove PC Restore from your computer, even to gain additional harddrive space. If you remove PC Restore from the hard drive, you cannot ever recall it, and you will never be able to use PC Restore to return your computer operating system to its original state.

- 1 Log on to the computer as a local administrator.
- 2 In Microsoft Windows Explorer, go to **c:\dell\utilities\DSR**.
- 3 Double-click the filename **DSRIRRemv2.exe**.



**NOTE:** If you do not log on as a local administrator, a message appears stating that you that you must log on as administrator. Click Quit, and then log on as a local administrator.





**NOTE:** If the partition for PC Restore does not exist on your computer hard drive, a message appears stating that the partition was not found. Click Quit; there is no partition to delete.

- 4 Click **OK** to remove the PC Restore partition on the hard drive.
- 5 Click **Yes** when a confirmation message appears.  
The PC Restore partition is deleted and the newly available disk space is added to the free space allocation on the hard drive.
- 6 Right-click **Local Disk (C)** in Windows Explorer, click **Properties**, and verify that the additional disk space is available as indicated by the increased value for **Free Space**.
- 7 Click **Finish** to close the **PC Restore Removal** window and restart the computer.

#### Windows Vista: Dell Factory Image Restore

- 1 Turn on the computer. When the Dell logo appears, press <F8> several times to access the Vista Advanced Boot Options window.
- 2 Select **Repair Your Computer**.  
The System Recovery Options window appears.
- 3 Select a keyboard layout and click **Next**.
- 4 To access the recovery options, log on as a local user. To access the command prompt, type `administrator` in the User name field, then click **OK**.
- 5 Click **Dell Factory Image Restore**.



**NOTE:** Depending upon your configuration, you may need to select Dell Factory Tools, then Dell Factory Image Restore.

The Dell Factory Image Restore welcome screen appears.

- 6 Click **Next**.

The Confirm Data Deletion screen appears.



**NOTICE:** If you do not want to proceed with Factory Image Restore, click Cancel.

- 7 Click the checkbox to confirm that you want to continue reformatting the hard drive and restoring the system software to the factory condition, then click **Next**.

The restore process begins and may take five or more minutes to complete. A message appears when the operating system and factory-installed applications have been restored to factory condition.

- 8 Click **Finish** to reboot the system.

## Using the Operating System Disc

### Before you Begin

If you are considering reinstalling the Windows operating system to correct a problem with a newly installed driver, first try using Windows Device Driver Rollback. See "Using Windows Device Driver Rollback" on page 130. If Device Driver Rollback does not resolve the problem, then use System Restore to return your operating system to the operating state it was in before you installed the new device driver. See "Using Microsoft Windows System Restore" on page 132.



**NOTICE:** Before performing the installation, back up all data files on your primary hard drive. For conventional hard drive configurations, the primary hard drive is the first drive detected by the computer.

To reinstall Windows, you need the following items:

- Dell™ *Operating System* disc
- Dell *Drivers and Utilities* disc



**NOTE:** The Dell *Drivers and Utilities* disc contains drivers that were installed during the assembly of the computer. Use the Dell *Drivers and Utilities* disc to load any required drivers. Depending on the region from which you ordered your computer, or whether you requested the disc, the Dell *Drivers and Utilities* disc and *Operating System* disc may not ship with your computer.

### Reinstalling Windows XP or Windows Vista

The reinstallation process can take 1 to 2 hours to complete. After you reinstall the operating system, you must also reinstall the device drivers, virus protection program, and other software.



**NOTICE:** The *Operating System* disc provides options for reinstalling Windows XP. The options can overwrite files and possibly affect programs that are installed on your hard drive. Therefore, do not reinstall Windows XP unless a Dell technical support representative instructs you to do so.

- 1 Save and close any open files and exit any open programs.

- 2 Insert the *Operating System* disc.
- 3 Click **Exit** if the `Install Windows` message appears.
- 4 Restart the computer.

When the DELL logo appears, press <F12> immediately.



**NOTE:** If you wait too long and the operating system logo appears, continue to wait until you see the Microsoft® Windows® desktop; then, shut down your computer and try again.



**NOTE:** The next steps change the boot sequence for one time only. On the next start-up, the computer boots according to the devices specified in the system setup program.

- 5 When the boot device list appears, highlight **CD/DVD/CD-RW Drive** and press <Enter>.
- 6 Press any key to **Boot from CD-ROM**.
- 7 Follow the instructions on the screen to complete the installation.

# 12 Adding and Replacing

## Parts

### Before You Begin

This chapter provides procedures for removing and installing the components in your computer. Unless otherwise noted, each procedure assumes that the following conditions exist:

- You have performed the steps in "Turning Off Your Computer" on page 139 and "Before Working Inside Your Computer" on page 140.
- You have read the safety information in the Dell™ *Product Information Guide*.
- A component can be replaced or—if purchased separately—installed by performing the removal procedure in reverse order.

### Recommended Tools

The procedures in this document may require the following tools:

- Small flat-blade screwdriver
- Small Phillips screwdriver
- Small plastic scribe


### Turning Off Your Computer



**NOTICE:** To avoid losing data, save and close all open files and exit all open programs before you turn off your computer.

- 1 Shut down the operating system:
  - a Save and close all open files and exit all open programs.

- b In the Microsoft® Windows® XP operating system, click **Start**→ **Shut Down**→ **Shut down**.

In the Microsoft Windows Vista™ operating system, click the Windows Vista Start button , click the arrow in the lower-right corner of the Start menu as shown below, and then click **Shut Down**.




The computer turns off after the operating system shutdown process is complete.

- 2 Ensure that the computer and all attached devices are turned off. If your computer and attached devices did not automatically turn off when you shut down your operating system, press and hold the power button for about 4 seconds to turn them off.

## Before Working Inside Your Computer

Use the following safety guidelines to help protect your computer from potential damage and to help to ensure your own personal safety.

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

 **CAUTION:** Use proper weight-lifting precautions when picking up the computer.




**NOTICE:** Handle components and cards with care. Do not touch the components or contacts on a card. Hold a card by its edges or by its metal mounting bracket. Hold a component such as a processor by its edges, not by its pins.




**NOTICE:** Only a certified service technician should perform repairs on your computer. Damage due to servicing that is not authorized by Dell is not covered by your warranty.




**NOTICE:** When you disconnect a cable, pull on its connector or on its pull-tab, not on the cable itself. Some cables have connectors with locking tabs; if you are disconnecting this type of cable, press in on the locking tabs before you disconnect the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before you connect a cable, ensure that both connectors are correctly oriented and aligned.

 **NOTICE:** To avoid damaging the computer, perform the following steps before you begin working inside the computer.

- 1 Ensure that the work surface is flat and clean to prevent the computer cover from being scratched.
- 2 Turn off your computer (see "Turning Off Your Computer" on page 139).

 **NOTICE:** To disconnect a network cable, first unplug the cable from your computer and then unplug the cable from the network device.


- 3 Disconnect all telephone or network cables from the computer.


 **NOTICE:** To avoid damaging the system board, you must remove the main battery before you service the computer.


- 4 Disconnect your computer and all attached devices from their electrical outlets.

## Removing the Computer Cover and Front Panel


### Removing the Computer Cover

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.


 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before removing the cover.

 **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

- 1 Follow the procedures in "Before You Begin" on page 139.

 **NOTICE:** Opening the computer cover while the computer is running could result in a shutdown without warning and a loss of data in open programs. The computer cooling system cannot function properly while the cover is removed.

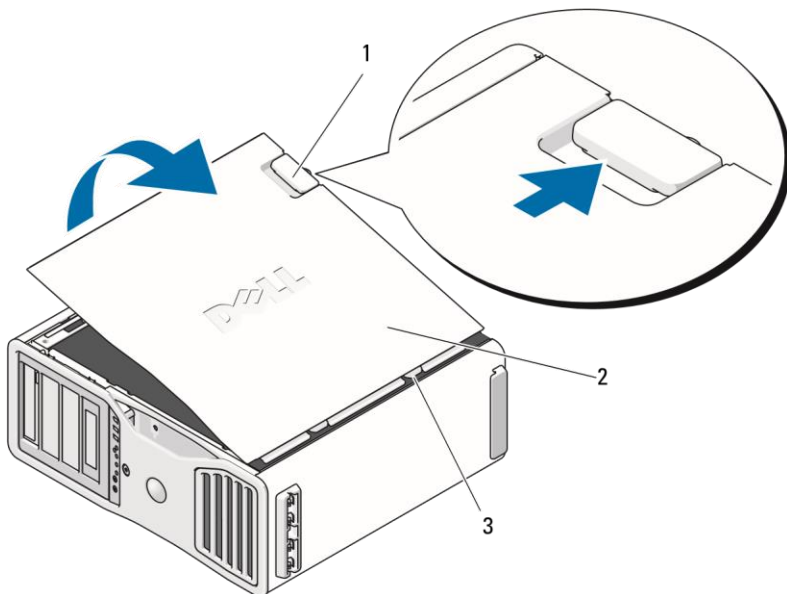
- 2 If you have installed a security cable, remove it from the security cable slot.

 **NOTICE:** Ensure that sufficient space exists to support the removed cover—at least 30 cm (1 ft) of desk top space.

**➡ NOTICE:** Ensure that you are working on a level, protected surface to avoid scratching either the computer or the surface on which it is resting.

**3** Lay your computer on a flat surface with the cover facing up.

**4** Pull back the cover latch release.



1 cover latch release

2 computer cover

3 cover hinges

**5** Locate the three hinge tabs on the edge of the computer.

**6** Grip the sides of the computer cover and pivot the cover up, using the hinges as leverage points.

**7** Release the cover from the hinge tabs and set it aside in a secure location.

**➡ NOTICE:** The computer cooling system cannot function properly while the computer cover is not installed. Do not attempt to boot the computer before replacing the computer cover.

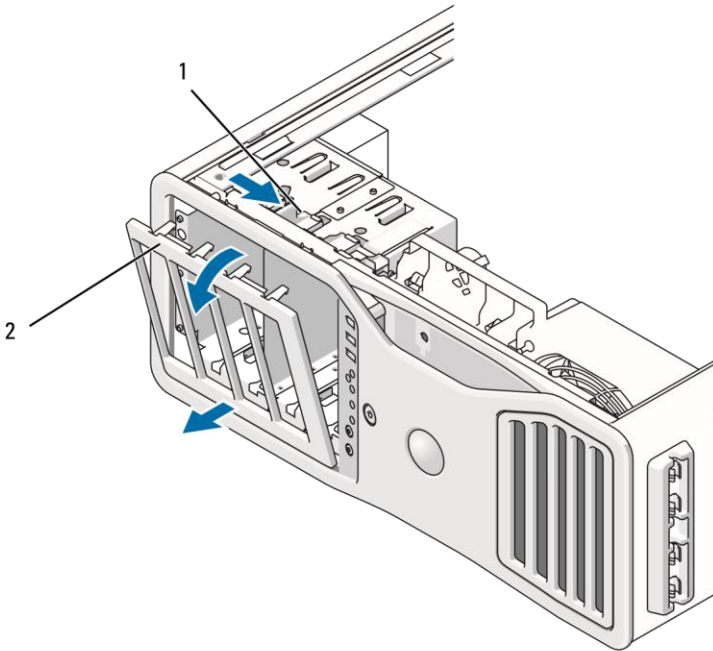
## Removing the Front Panel

**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

**⚠ CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before removing the cover.

**➡ NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

Pull the front-panel release lever, and slide the panel to the right to remove the front panel.



1 front-panel release lever    2 front panel

## Replacing the Front Panel and Computer Cover

**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

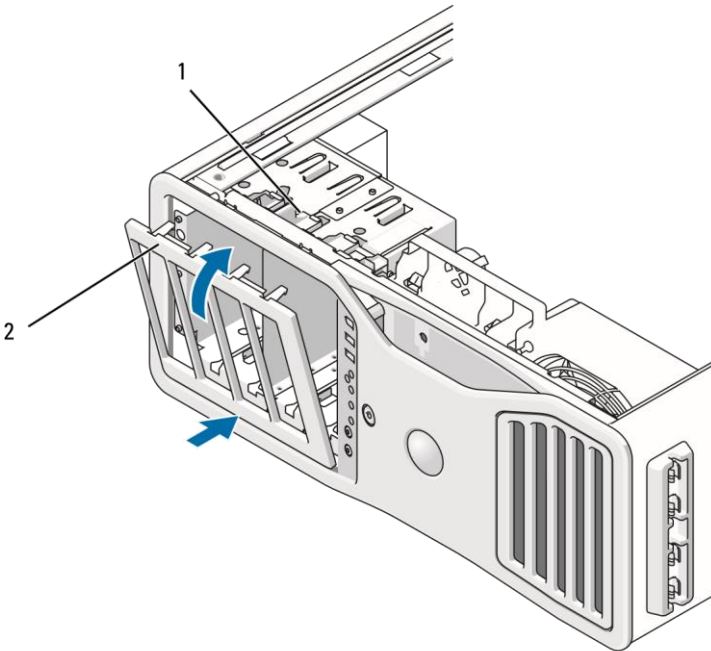


**⚠ CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.

**🔁 NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

## Replacing the Front Panel

- 1 Align the hooks on the front panel with the corresponding holes on the front of the computer.



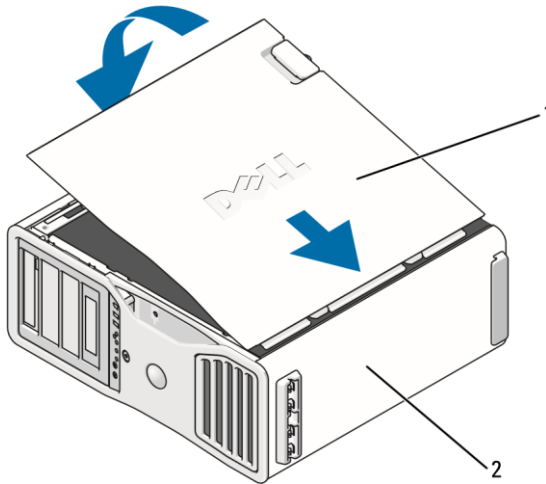
1 front-panel release lever      2 front panel

- 2 Pull the front-panel release lever, and slide the panel to the right to engage and secure the front panel.

## Replacing the Computer Cover

**NOTICE:** The computer cooling system cannot function properly while the computer cover is not installed. Do not attempt to boot the computer before replacing the computer cover.

- 1 Ensure that all cables are connected, and fold cables out of the way. Gently pull the power cables toward you so that they do not get caught underneath the drives.
- 2 Ensure that no tools or extra parts are left inside the computer.
- 3 Replace the cover:
  - a Align the computer cover with the tabs on the computer base.
  - b Pivot the cover down and gently press the cover until it clicks into place.
  - c Ensure that the cover is locked. If not, repeat all of step 3.



1 computer cover

2 computer base

**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

- 4 Connect your computer and devices to electrical outlets, and turn them on.

- 5 After you open and close the cover, the chassis intrusion detector, if enabled, causes the following message to appear on the screen at the next computer start-up:  
ALERT! Cover was previously removed.
- 6 Reset the chassis intrusion detector by changing Intrusion Alert to Enabled or Enabled-Silent. See "Resetting the Chassis Intrusion Detector" on page 62.
- 7 If a setup password has been assigned by someone else, contact your network administrator for information on resetting the chassis intrusion detector.

## I/O Panel



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

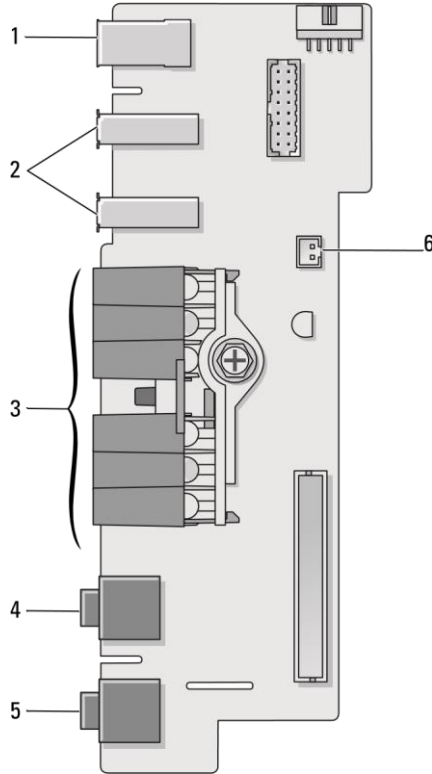


**CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.



**NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

# I/O-Panel Components





- 1 IEEE 1394 connector
- 2 USB ports (2)
- 3 diagnostic, hard-drive access, and network integrity lights
- 4 microphone connector
- 5 headphone connector
- 6 front-panel air temperature sensor

**NOTICE:** The front-panel temperature sensor cable must be installed in this connector at all times while your computer is running or thermal problems may result.


## Removing the I/O Panel

- 1 Follow the procedures in "Before You Begin" on page 139.

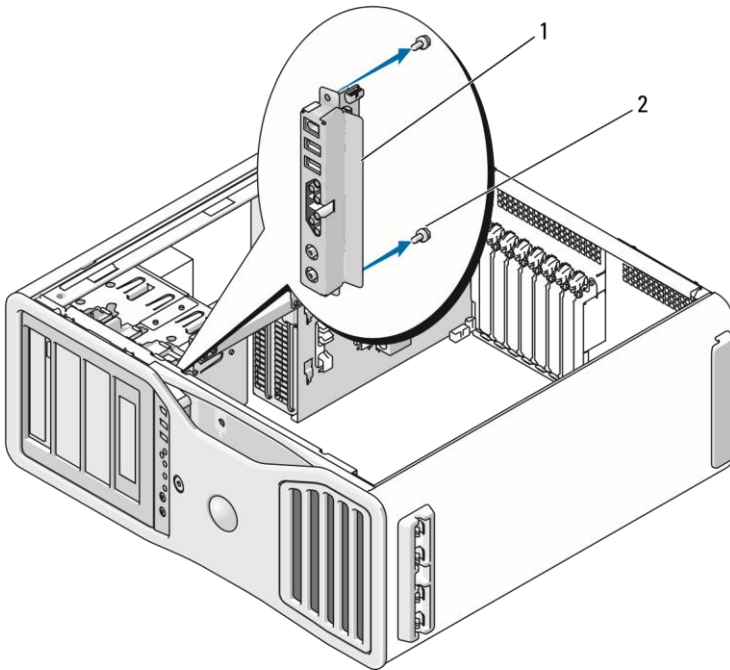
 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Remove any full-length expansion cards (see "Removing an Expansion Card" on page 202).
- 4 If a graphics riser card is installed, remove it:
  - a Remove its four screws. b Disconnect its power cable.
  - c Move it slightly up and to the right at an angle to free it from the card fan and the memory-riser support structure.
  - d Set the riser aside.
- 5 Loosen the captive thumbscrews that secure the memory shroud and lift to remove it from the computer.
- 6 Disconnect the speaker cable from the system board.
- 7 Disconnect the front fan and the card fan from the system board.
- 8 Unscrew the two screws that hold the processor and card fan case in place and lift it away from the computer.
- 9 Disconnect the control-panel cable from the I/O panel connector by pulling with the cable loop.

 **NOTICE:** Carefully note the routing of each cable before you disconnect it, so that you are sure to re-route cables correctly. An incorrectly routed or a disconnected cable could lead to computer problems.

- 10 Note the routing of each cable as you disconnect all cables attached to the I/O panel.



1 I/O panel

2 mounting screws

- 11 Remove the mounting screws from the I/O panel.
- 12 Lift to remove the I/O panel from the computer.

### Replacing the I/O Panel

**NOTICE:** Ensure that you replace all cables originally attached to the I/O panel or you may experience computer problems.

Follow the removal procedure ("Removing the I/O Panel" on page 148) in reverse order. Ensure that the plastic piece that fits over the screw hole is in place, secured by the screw that fastens the I/O panel to the chassis.

# Processor



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.



**CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.



**NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

## Removing the Processor

- 1 Follow the procedures in "Before You Begin" on page 139.

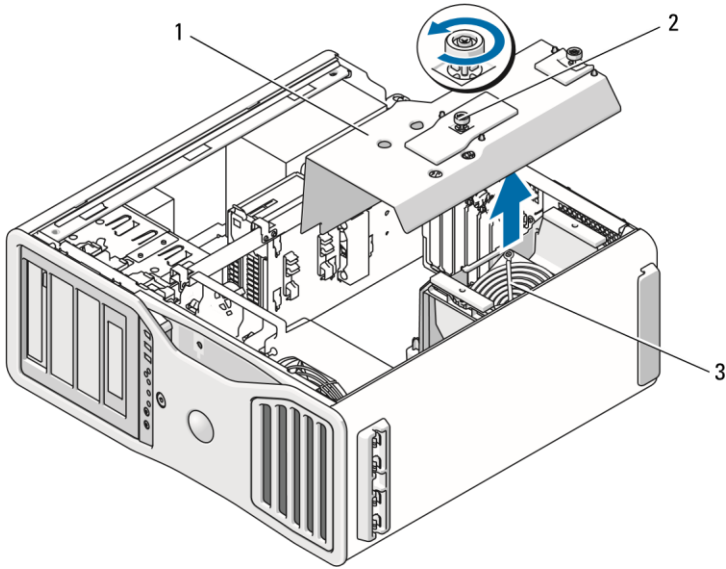


**CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.




**CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.


- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Loosen the captive thumbscrews that secure the memory shroud and lift it away from the computer.
- 4 Lift the memory fan away from the computer to access the heatsink screws.



- 1 memory shroud
- 2 thumbscrews (2)
- 3 memory fan (only present on computers without memory riser cards)

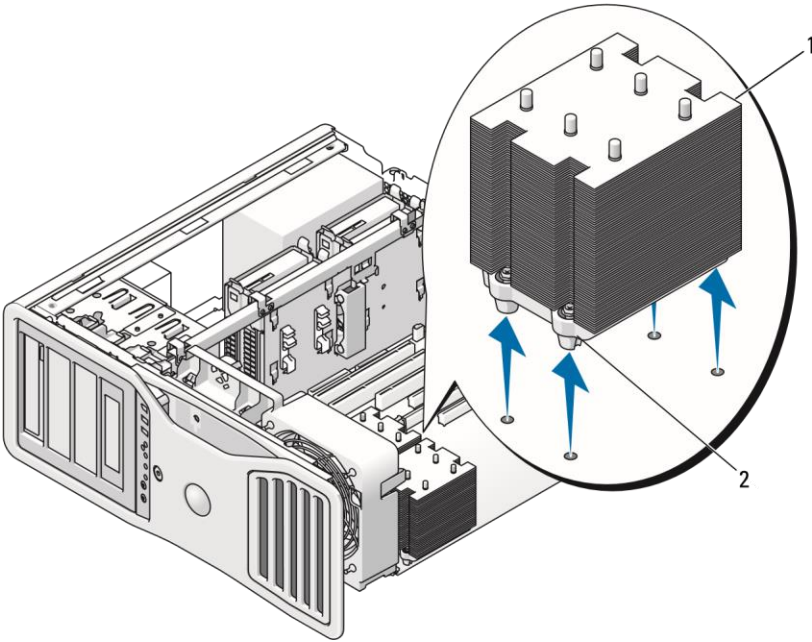
 **NOTE:** To loosen the two captive screws on each side of the heat-sink assembly, you need a long Phillips screwdriver.

- 5 Loosen the two captive screws on each side of the heat-sink assembly.

 **CAUTION:** Despite having a plastic shield, the heat-sink assembly may be very hot during normal operation. Ensure that it has had sufficient time to cool before you touch it.

- 6 Rotate the heat-sink assembly upward, and remove it from the computer.



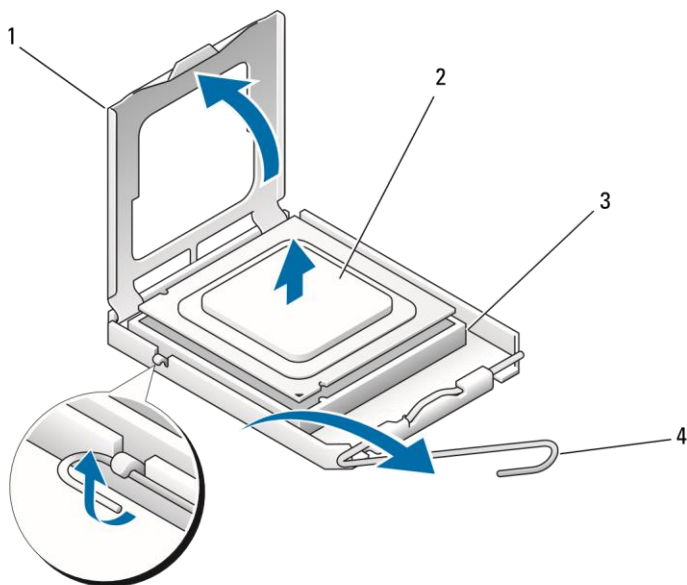


1 heat-sink assembly

2 captive screw housing (4)

**NOTICE:** If you are installing a processor upgrade kit from Dell, discard the original heat-sink assembly. If you are not installing a processor upgrade kit from Dell, reuse the original heat-sink assembly when you install your new processor.

- 7 Open the processor cover by sliding the release lever from under the center cover latch on the socket. Then, pull the lever back to release the processor.



1 processor cover

2 processor

3 socket

4 release lever

**NOTICE:** When replacing the processor, do not touch any of the pins inside the socket or allow any objects to fall on the pins in the socket.

8 Gently remove the processor from the socket.

9 If you are installing a new processor, leave the release lever extended in the release position so that the socket is ready for the new processor. See "Installing the Processor" on page 154.

Otherwise, continue with step 10.

**NOTICE:** The memory shroud holds the (optional) memory risers in place; its thumbscrews must be sufficiently tight in order to secure the risers and to avoid damage.

10 Replace the memory shroud and the memory fan. Tighten the thumbscrews until the memory shroud is well secured and will not shift when the computer is moved.

11 Ensure that all connectors are properly cabled and firmly seated.

- 12 Replace the computer cover (see "Replacing the Computer Cover" on page 145).

## Installing the Processor



**NOTICE:** Ground yourself by touching an unpainted metal surface on the back of the computer.



**NOTICE:** When replacing the processor, do not touch any of the pins inside the socket or allow any objects to fall on the pins in the socket.

- 1 Follow the procedures in "Before You Begin" on page 139.

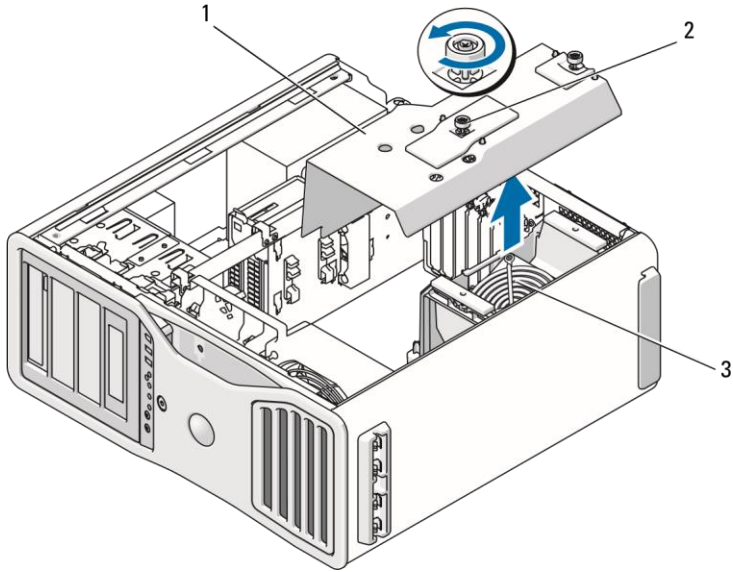


**CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.



**CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Loosen the captive thumbscrews that secure the memory shroud and lift it away from the computer.



1 memory shroud

2 thumbscrews (2)

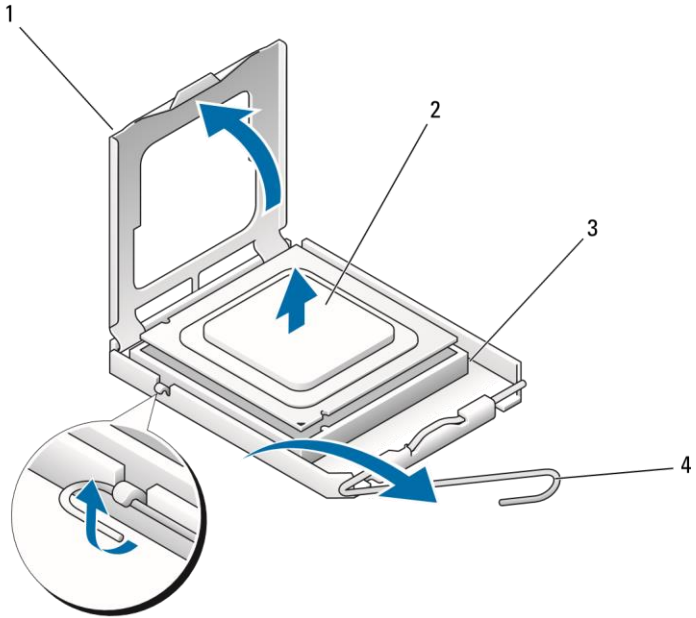
3 memory fan (only present on systems without memory riser cards)

- 4 If you are replacing a processor, remove the processor (see "Removing the Processor" on page 150).
- 5 Unpack the new processor, being careful not to touch the underside of the processor.



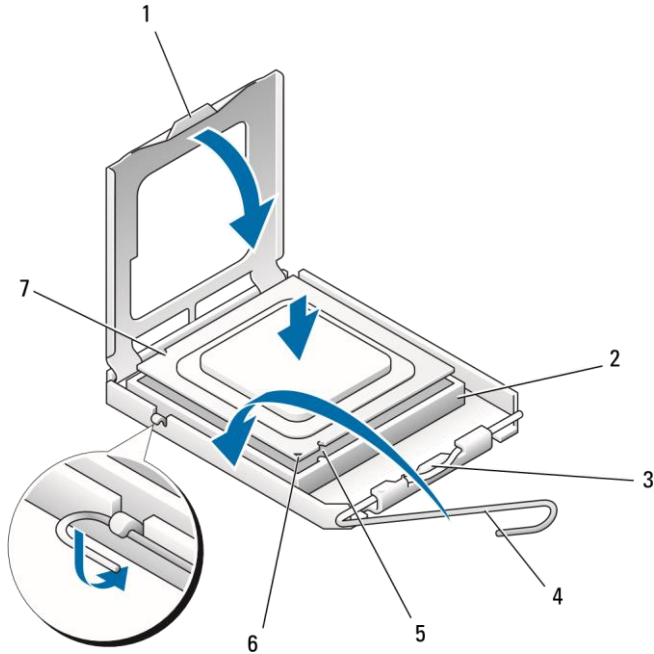
**NOTICE:** You must position the processor correctly in the socket to avoid permanent damage to the processor and the computer when you turn on the computer.

- 6 Open the processor cover by sliding the release lever from under the center cover latch on the socket. Ensure that the release lever is fully extended.



- |                   |                 |
|-------------------|-----------------|
| 1 processor cover | 2 processor     |
| 3 socket          | 4 release lever |

- 7 Orient the front and rear alignment notches on the processor with the front and rear alignment notches on the socket.
- 8 Align the pin-1 corners of the processor and socket.



- |   |                       |   |                                      |
|---|-----------------------|---|--------------------------------------|
| 1 | tab                   | 2 | processor socket                     |
| 3 | center cover latch    | 4 | socket release lever                 |
| 5 | front alignment notch | 6 | socket and processor pin-1 indicator |
| 7 | rear alignment notch  |   |                                      |

**➔ NOTICE:** To avoid damage, ensure that the processor aligns properly with the socket, and do not use excessive force when you install the processor.

- 9 Set the processor lightly in the socket and ensure that the processor is positioned correctly.
- 10 When the processor is fully seated in the socket, close the processor cover. Ensure that the tab on the processor cover is positioned underneath the center cover latch on the socket.
- 11 Pivot the socket release lever back toward the socket and snap it into place to secure the processor.

- 12 Clean the thermal grease from the bottom of the heat sink.
- 13 Apply the new thermal grease to the top of the processor.



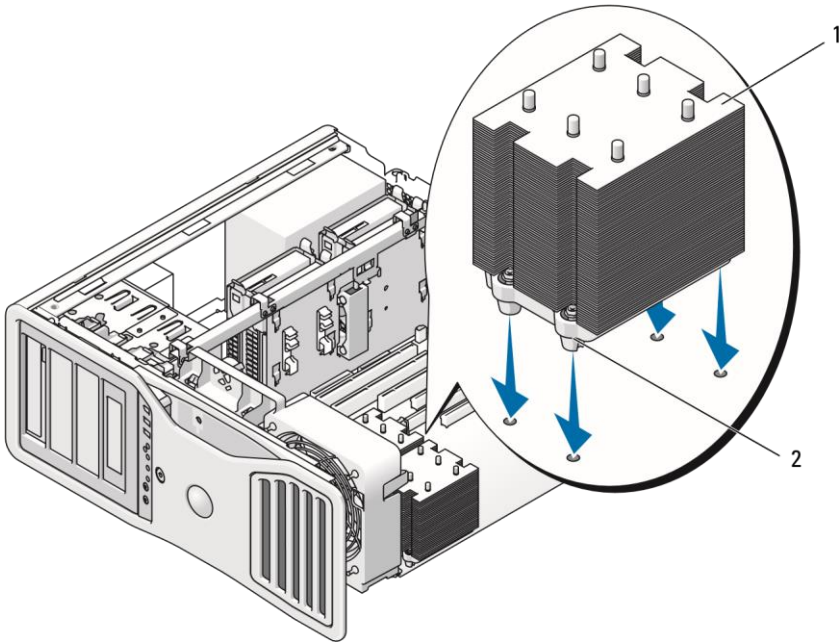
**NOTICE:** If you are *not* installing a processor upgrade kit from Dell, reuse the original heat-sink assembly when you replace the processor.

If you installed a processor replacement kit from Dell, return the original heat-sink assembly and processor to Dell in the same package in which your replacement kit was sent.

- 14 Install the heat-sink assembly:
  - a Place the heat-sink assembly back onto the heat-sink assembly bracket.
  - b Rotate the heat-sink assembly down towards the computer base and tighten the four captive screws.



**NOTICE:** Ensure that the heat-sink assembly is correctly seated and secure.



1 heat-sink assembly

2 captive screw housing (4)

**NOTICE:** The memory shroud holds the (optional) memory risers in place; its thumbscrews must be sufficiently tight in order to secure the risers and to avoid damage.

**15** Replace the memory shroud and memory fan. Tighten the thumbscrews until the memory shroud is well secured and will not shift when the computer is moved.

**16** Ensure that all connectors are properly cabled and firmly seated.

**17** Replace the computer cover (see "Replacing the Computer Cover" on page 145).

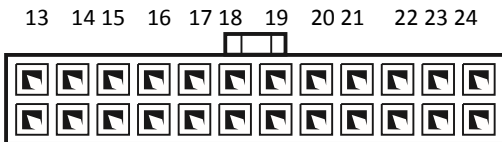
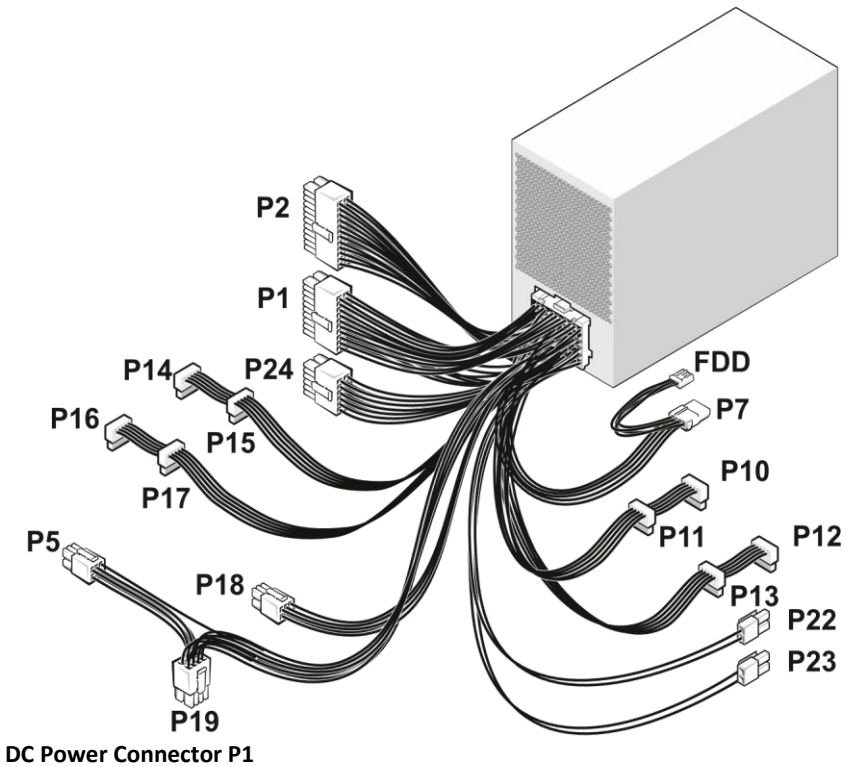
**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.



- 18 Connect the computer and devices to electrical outlets, and turn them on.
- 19 Press <F2> to enter system setup and check under Processor Info to verify that the new processor has been installed properly.

## Power Supply

### DC Connector Pin Assignments



1 2 34 5 6 7 8 9 1011 12

Pin Number	Signal name	Wire Color	Wire Size
1	3.3 V	Orange	18 AWG
2	3.3 V	Orange	18 AWG
3	3.3 V	Orange	18 AWG
4	COM	Black	18 AWG
5	POK	Gray	18 AWG
6	5 VSB	Purple	18 AWG
7	COM	Black	18 AWG
8	M12	Blue	18 AWG
9	12 VD	Yellow/ White	18 AWG
10	5 V	Red	18 AWG
11	5 V	Red	18 AWG
12	COM	Black	18 AWG
13	COM	Black	18 AWG
14	3.3 V	Orange	18 AWG
	3.3V SE	Orange	22 AWG
15	3.3 V	Orange	18 AWG
16	12 VD	Yellow/ White	18 AWG
17	PSON	Green	18 AWG
18	12 VD	Yellow/ White	18 AWG
Pin Number	Signal name	Wire Color	Wire Size
19	COM	Black	18 AWG
20	COM	Black	18 AWG
21	FAN FAULT	Brown	18 AWG
22	5 V	Red	18 AWG
23	5 V	Red	18 AWG

24 COM Black 18 AWG

### DC Power Connectors P2

11 12 13 14 15 16 17 18 19 20

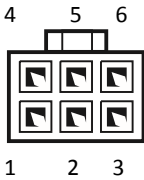


1 2 3 4 5 6 7 8 9 10

Pin Number	Signal Name	18-AWG Wire
1	12 VC	Blue/White
2	12 VC	Blue/White
3	COM	Black
4	COM	Black
5	12 VA	Yellow
6	12 VA	Yellow
7	COM	Black
8	COM	Black
9	12 VB	White
10	12 VB	White
11	12 VC	Blue/White
12	COM	Black
13	COM	Black

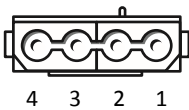
Pin Number	Signal Name	18-AWG Wire
14	COM	Black
15	12 VA	Yellow
16	COM	Black
17	COM	Black
18	COM	Black
19	12 VB	White
20	OPEN	

### DC Power Connector P5



Pin Number	Signal name	18-AWG Wire
1	12 VD	Yellow/White
2	12 VD	Yellow/White
3	12 VD	Yellow/White
4	COM	Black
5	COM	Black
6	COM	Black

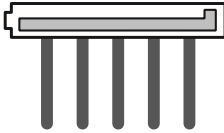
### DC Power Connector P7



Pin Number	Signal Name	18-AWG Wire
1	12 VCDC	Blue/White

2	GND	Black
3	GND	Black
4	+5 V	Red

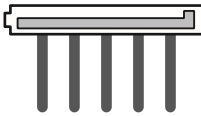
**DC Power Connectors P10, P11**



5 4 3 2 1

Pin Number	Signal name	18-AWG Wire
1	+3.3 VDC	Orange
2	COM	Black
3	+5 VDC	Red
4	COM	Black
5	+12 VB	White

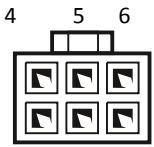
**DC Power Connectors P12, P13, P14, P15, P16, P17**



Pin Number	Signal name	18-AWG Wire
1	+3.3 VDC	Orange
2	COM	Black
3	+5 VDC	Red
4	COM	Black

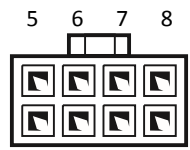
Pin Number	Signal name	18-AWG Wire
5	+12 VC	Blue/White

**DC Power Connector P18**



Pin Number	Signal name	18-AWG Wire
1	12 VE	Blue/Yellow
2	12 VE	Blue/Yellow
3	12 VE	Blue/Yellow
4	COM	Black
5	COM	Black
6	COM	Black

**DC Power Connector P19**



Pin Number	Signal name	18-AWG Wire
1	COM	Black
2	12 VD	Yellow/White
3	12 VD	Yellow/White
4	3.3 V	Orange
5	COM	Black

Pin Number	Signal name	18-AWG Wire
6	COM	Black
7	COM	Black
8	3.3 V	Orange

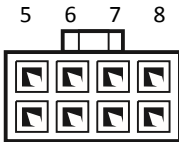
#### DC Power Connector P22, P23



1	2	20-AWG Wire
---	---	----------------

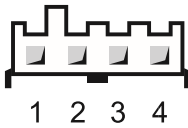
Pin Number	Signal name	Wire
1	12 VA	Yellow
2	COM	Black

#### DC Power Connector P24



1	2	3	4	5	6	7	8	18-AWG Wire
1	2	3	4	5	6	7	8	Blue/Yellow
								Blue/Yellow
								Blue/Yellow
								Black
								Black
								Black
								Black
								Black
								Black

## DC Power Connector FDD



Pin Number	Signal name	18-AWG Wire
1	5 V	Red
2	COM	Black
3	COM	Black
4	12 VC	Blue/White

## Removing the Power Supply

**CAUTION:** Before performing any of the procedures in this section, follow the safety instructions in the Product Information Guide.

**CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.

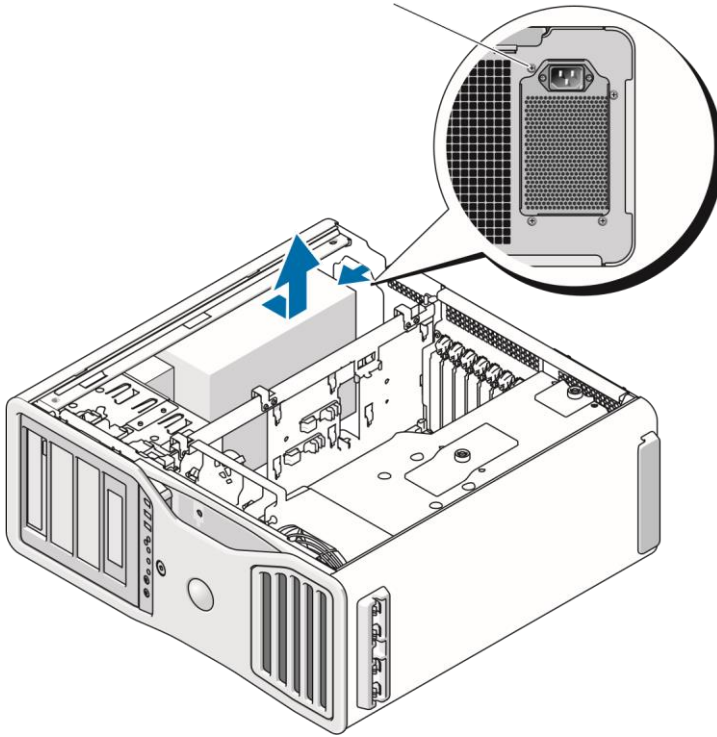
**NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

- 1 Follow the procedures in "Before You Begin" on page 139.
- 2 Remove the computer cover. See "Removing the Computer Cover" on page 141.
- 3 Disconnect the DC power cables from the system board, the drives, and any other cards or devices to which they are connected.

Note the routing of the DC power cables underneath the tabs in the computer frame as you release the tabs and remove the cables from the system board and drives. You must route these cables properly when you replace them to prevent their being pinched or crimped.

- 4 Remove the four screws that attach the power supply to the back of the computer chassis.






1 power supply screws (4)





- 5 Slide the power supply toward the front of the computer by approximately one inch.
- 6 Lift the power supply out of the computer.

### Replacing the Power Supply

- 1 Slide the power supply into place.
- 2 Replace the four screws that secure the power supply to the back of the computer chassis.
- 3 Reconnect the DC power cables.
- 4 On the computer, reattach the power cables to the side of the hard drive.

- 5 Run the cables underneath the tabs, and press the tabs to close them over the cables.
  - 6 Replace the computer cover (see "Replacing the Computer Cover" on page 145).
-  **NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.
- 7 Connect your computer and devices to electrical outlets, and turn them on.

## Battery

-  **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.
-  **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.
-  **CAUTION:** A new battery can explode if it is incorrectly installed. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.
-  **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

### About the Battery

A coin-cell battery maintains computer configuration, date, and time information. The battery can last several years.

The battery may need replacing if you have repeatedly reset the time and date information after turning on the computer or if one of the following messages appear:

```
Time-of-day not set - please run SETUP program
```

or

```
Invalid configuration information -  
please run SETUP program
```

or


Strike the F1 key to continue,  
F2 to run the setup utility


To determine whether you need to replace the battery, re-enter the time and date in system setup and exit the program to save the information. Turn off your computer and disconnect it from the electrical outlet for a few hours; then reconnect the computer, turn it on, and enter system setup. If the date and time are not correct in system setup, replace the battery.

You can operate your computer without a battery; however, without a battery, the configuration information is erased if the computer is turned off or unplugged from the electrical outlet. In this case, you must enter system setup and reset the configuration options.


## Removing the Battery

- 1 If you have not already done so, write down your configuration information found in system setup (see "System Setup" on page 75).
- 2 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

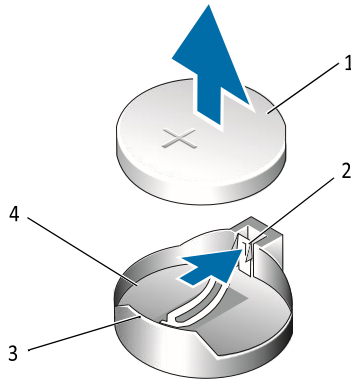
 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 3 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 4 Locate the battery socket.

 **NOTICE:** If you pry the battery out of its socket with a blunt object, be careful not to touch the system board with the object. Ensure that the object is inserted between the battery and the socket before you attempt to pry out the battery. Otherwise, you may damage the system board by prying off the socket or by breaking circuit traces on the system board.

**NOTICE:** To avoid damage to the battery connector, you must firmly support the connector while removing the battery.

- 5 Support the battery connector by pressing down firmly on the positive side of the connector.
- 6 While supporting the battery connector, press the battery tab away from the positive side of the connector and pry the battery up out of the securing tabs at the negative side of the connector.



- |   |                                    |   |                    |
|---|------------------------------------|---|--------------------|
| 1 | system battery                     | 2 | battery socket tab |
| 3 | positive side of battery connector | 4 | battery socket     |

- 7 Properly dispose of the old battery. For more information, see your *Product Information Guide*.

## Replacing the Battery


- 1 Follow the procedures in "Before You Begin" on page 139.

**CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your *Product Information Guide* for other important safety information.


**CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the

**computer tipping over, potentially resulting in bodily injury or damage to the computer.**

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Locate the battery socket.
- 4 Remove the existing battery. See "Removing the Battery" on page 170.

 **NOTICE:** To avoid damage to the battery connector, you must firmly support the connector while replacing the battery.


- 5 Support the battery connector by pressing down firmly on the positive side of the connector.
- 6 Hold the battery with the "+" facing up, and slide it under the securing tabs at the positive side of the connector.
- 7 Press the battery straight down into the connector until it snaps into place.
- 8 Replace the computer cover (see "Removing the Computer Cover" on page 141).


 **NOTICE:** To connect a network cable, first plug the cable into the network device and then plug it into the computer.


- 9 Connect your computer and devices to electrical outlets, and turn them on.
- 10 Enter system setup (see "Entering System Setup" on page 75) and restore the settings that you recorded when you removed the existing battery.

## Memory

Your computer supports fully-buffered ECC DDR2 memory only. For more information on the type of memory supported by your computer, see "Specifications" on page 29.


 **NOTICE:** Before you install new memory modules, download the most recent BIOS for your computer from the Dell Support website at [support.dell.com](http://support.dell.com).

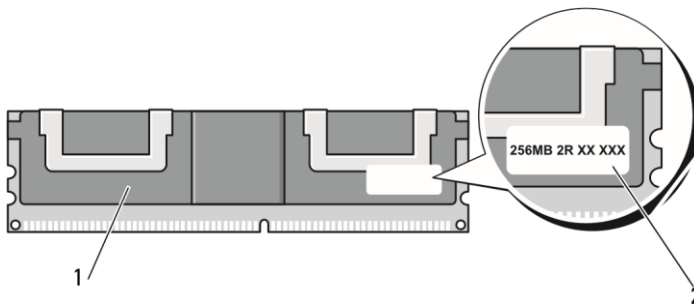
 **NOTICE:** Full-length heat spreaders (FLHS) are required for all DIMMs.

 **NOTE:** Memory purchased from Dell is covered under your computer warranty.

## Fully Buffered DIMM (FBD) Memory Overview

For optimal performance, fully buffered DIMMs (FBDs) should be installed in matched sets of four. This enables quad-channel operation and provides the highest memory bandwidth. The sets of four must be matched in size, rank, and organization. This information can normally be found on the FBD label. For example, the label of each FBD in a set of four might read: *1G 2R x8*, in which *1G* represents the size of the memory module, *2R* represents the number of ranks, and *x8* represents the organization.

 **NOTICE:** Full-length heat spreaders (FLHS) are required for all memory.




1 fully buffered DIMM


2 information label

## Memory Installation

Fully buffered DDR2 memory modules can also be installed in pairs of two; in this case, the computer will continue to operate, but with a slight reduction in performance. The pairs must be matched in size, rank, and organization.

Install memory modules in order of their labels on the system board; matched sets of four should be installed first into DIMM slots 1-4 and then into DIMM slots 5-8 on the system board. Pairs of memory should be first installed into slots DIMM\_1, and DIMM\_2, then DIMM\_3 and DIMM\_4, and so on.

 **NOTICE:** Do not install non-ECC or unbuffered memory modules. Doing so may cause the computer not to boot.

 **NOTE:** DIMM slots 1-4 have white latches for easy identification. DIMM slot 5-8 have black latches.

## Addressing Memory With 4-GB or Greater Configurations (32-bit Operating Systems Only)


This computer supports a maximum of 32 GB of memory when eight 4-GB DIMMs are installed. Current 32-bit operating systems, such as Microsoft® Windows® XP and Windows Vista, can use a maximum of 4 GB of address space; however, the amount of memory available to the operating system is less than that installed. Certain components within the computer require address space in the 4-GB range. Any address space reserved for these components cannot be used by computer memory. The following components require memory address space:


- System ROM
- APIC(s)
- Integrated PCI devices, such as network connectors and SCSI controllers
- PCI cards
- Graphics card
- PCI Express cards (if applicable)

At start-up, the BIOS identifies the components that require address space. The BIOS dynamically calculates the amount of reserved address space required. The BIOS then subtracts the reserved address space from 4 GB to determine the amount of usable space.

- If the total installed computer memory is less than the usable address space, all installed computer memory is available for use only by the operating system.
- If the total installed computer memory is equal to or greater than the usable address space, a portion of installed memory is not available for use by the operating system.

### Removing Memory Without Memory Riser Cards

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.



**NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

- 1 Follow the procedures in "Before You Begin" on page 139.



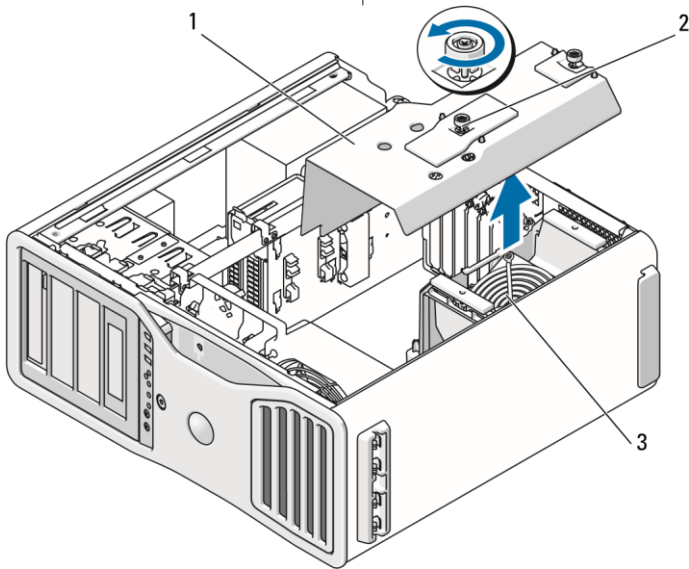
**CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.



**CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Loosen the captive thumbscrews that secure the memory shroud and lift it away from the computer.





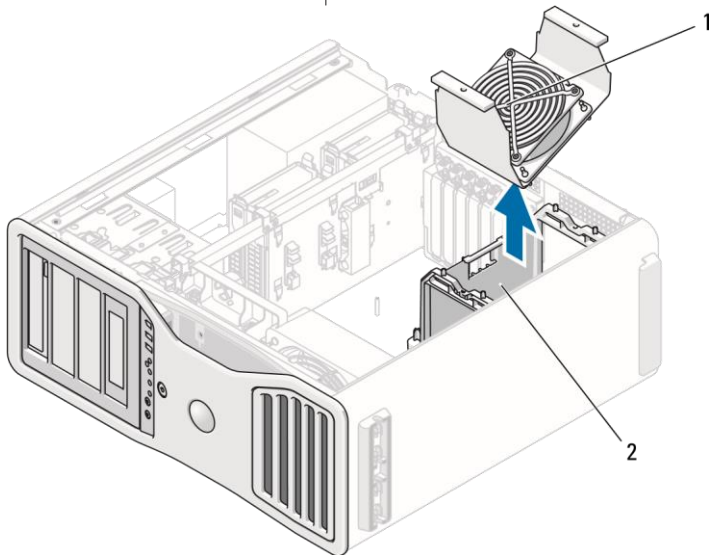
- 1 memory shroud                      2 thumbscrews (2)  
3 memory fan

4 Note the position of the memory fan, then lift the memory fan free from the fan support structure and set it aside.

- 1 memory fan                      2 memory fan support structure



**CAUTION:** Fully-buffered memory modules may become very hot during normal operation. Ensure that memory modules have had sufficient time to cool before you touch them.



**5** Press out the securing clip at each end of the memory module connector.

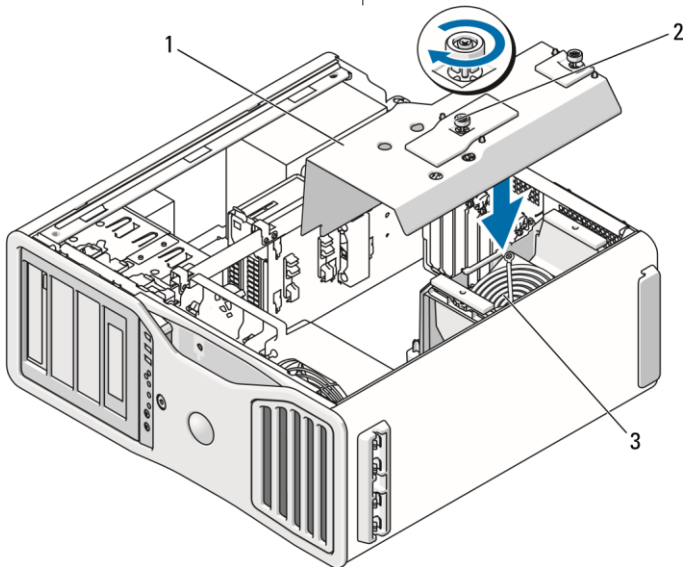
**6** Grasp the module and pull up.

If the module is difficult to remove, gently ease the module back and forth to remove it from the connector.

**7** Replace the memory fan on the fan support structure.

1 memory shroud                      2 thumbscrews (2)

3 memory fan



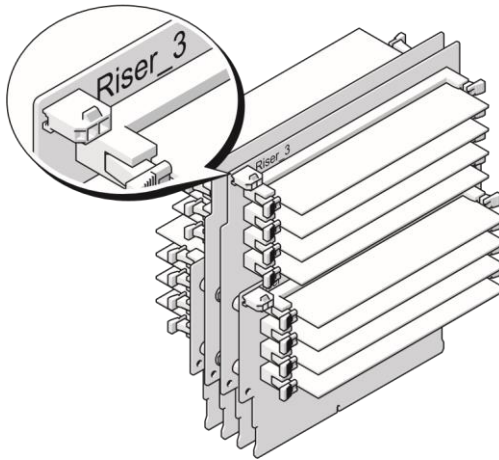
- 1** **NOTICE:** The memory shroud holds the (optional) memory risers in place; its thumbscrews must be sufficiently tight in order to secure the risers and to avoid damage.
- 8** Replace the memory shroud. Tighten the thumbscrews until the memory shroud is well secured and will not shift when the computer is moved.
- 9** Replace the computer cover (see "Replacing the Computer Cover" on page 145).
- 1** **NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

**10** Connect your computer and devices to electrical outlets, and turn them on.

## Memory Installation (With Optional Memory Riser Cards)


**NOTICE:** The memory shroud holds the (optional) memory risers in place; its thumbscrews must be sufficiently tight in order to secure the riser cards and to avoid damage.

The four memory riser cards that you received with your computer are connected together in sets of two. Do not attempt to disconnect the memory riser cards from each other. Each memory riser card is numbered in the upper left hand corner. These numbers indicate which DIMM slot on the system board each riser card must be inserted into. Only the DIMM\_1-4 slots (the slots with the white securing clips) on the system board can be used with the riser cards. The other slots (DIMM\_5-8) *must* be left vacant.





You must remove the memory riser cards from the computer in order to install memory on them. The memory slots on each riser card are numbered DIMM\_1- DIMM\_4. Memory must be installed on these cards in the order that they are numbered; that is, DIMM\_1 on riser card 1 must be populated before DIMM\_1 is populated on any other card. DIMM\_1 must be populated on each card before DIMM\_2 can be populated on riser card 1, and so on. Memory must be installed in sets of four with one of the four on each riser card.


Install memory modules in order of their labels on the system board; matched sets of four should be installed first into DIMM\_1 on each board and then DIMM\_2 on each board, and so on.

 **NOTICE:** Do not install non-ECC, unbuffered, or non-fully-buffered memory modules. Doing so may cause the system not to boot.


## Installing Memory (With Optional Memory Riser Cards)


 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.

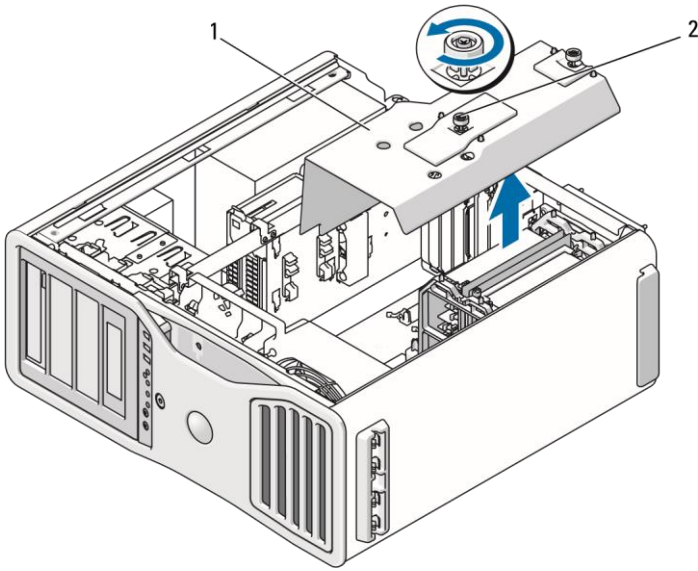
 **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).



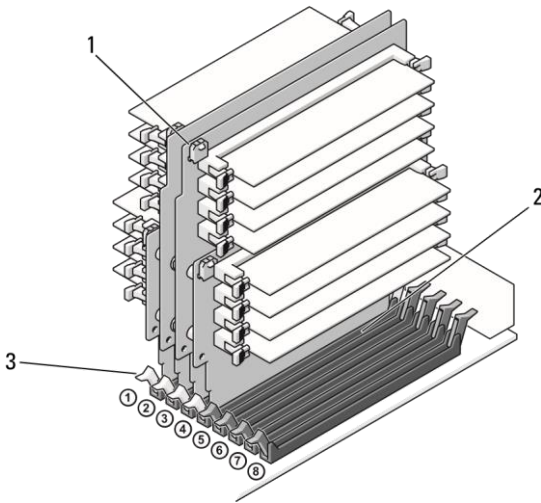
1 memory shroud

2 thumbscrews (2)

- 3 Loosen the captive thumbscrews that secure the memory shroud and lift it away from the computer.



**CAUTION:** Fully-buffered memory modules may become very hot during normal operation. Ensure that memory modules have had sufficient time to cool before you touch them.



1 power connectors (4)

2 memory connectors (4)

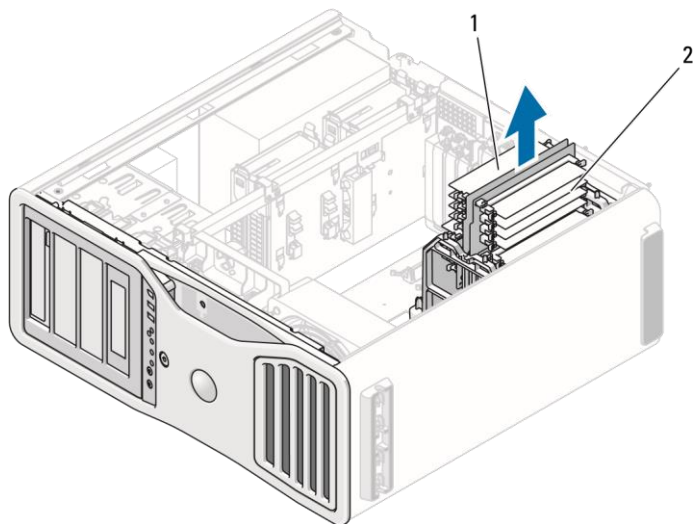
3 securing clips (2)

4 Disconnect the power cable from memory riser card 1 and 2.

5 Grasp the memory riser card 1 at each corner and lift memory riser card 1 and attached card 2 from the DIMM\_1 and DIMM\_2 slots on the system board.

If a card is difficult to remove, gently ease it back and forth to remove it from the connector.







1 memory riser cards 1 and 2    2 memory riser cards 3 and 4


- 6 Disconnect the power cables from memory riser cards 3 and 4.
- 7 Grasp the memory riser card 3 at each corner and lift memory riser cards 3 and attached card 4 from the DIMM\_3 and DIMM\_4 memory module connectors on the system board.

If a card is difficult to remove, gently ease it back and forth to remove it from the connector.

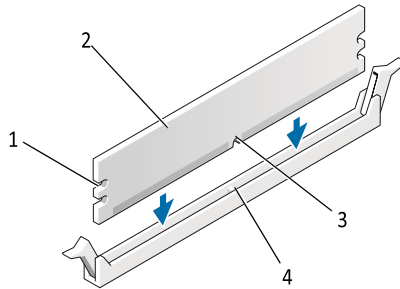
 **CAUTION:** Fully-buffered memory modules may become very hot during normal operation. Ensure that memory modules have had sufficient time to cool before you touch them.

- 8 Press out the securing clip at each end of the module connector on the memory riser card into which you are installing memory.

 **NOTICE:** Full-length heat spreaders (FLHS) are required for any memory in a memory riser and for 667 MHz DIMMs.

 **NOTE:** Align the memory module carefully to ensure that it is facing the correct direction; FBDs on memory riser cards 1 and 2 face a different direction than those on riser cards 3 and 4.

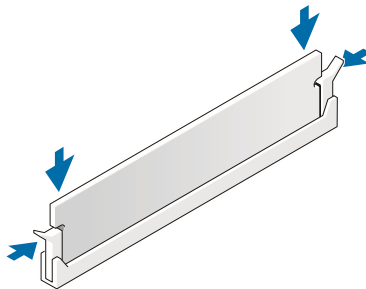
- 9 Align the notch on the bottom of the module with the crossbar in the connector.



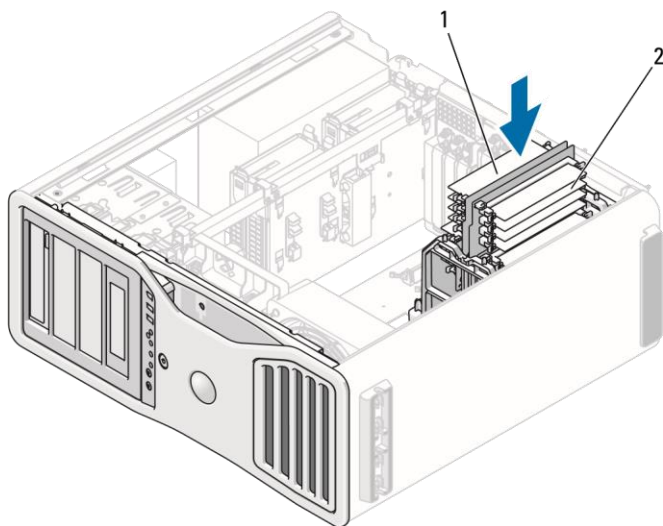
- |               |                 |
|---------------|-----------------|
| 1 cutouts (2) | 2 memory module |
| 3 notch       | 4 crossbar      |

**NOTICE:** To avoid damage to the memory module, press the module straight down into the connector while you apply equal force to each end of the module.

- 10 Insert the module into the connector until the module snaps into position. If you insert the module correctly, the securing clips snap into the cutouts at each end of the module.



- 11 Ensure that memory riser card 3 is above system-board connector DIMM\_3 and memory riser card 4 is above system-board connector DIMM\_4. Align the notch on the bottom of each riser card with the crossbar in each system-board connector.
- 12 Insert the riser cards into the connectors until both riser cards snap into position.



1 memory riser cards 1 and 2    2 memory riser cards 3 and 4



**NOTE:** If a memory-riser power cable is not plugged in, the system will not boot. **13**

Connect the power cables back into memory riser cards 3 and 4.

- 14** Ensure that memory riser card 1 is above system-board connector DIMM\_1 and memory riser card 2 is above system-board connector DIMM\_2.

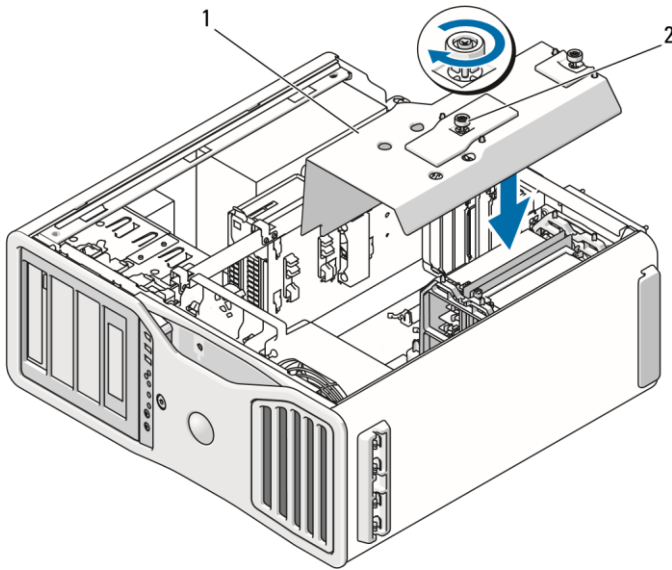
Align the notch on the bottom of each riser card with the crossbar in each system-board connector.

- 15** Insert the riser cards into the connectors until both riser cards snap into position.



**NOTE:** If a memory-riser power cable is not plugged in, the system will not boot.

- 16** Connect the power cables back into memory riser cards 1 and 2.



1 memory shroud

2 thumbscrews (2)

➔ **NOTICE:** The memory shroud holds the (optional) memory risers in place; its thumbscrews must be sufficiently tight in order to secure the risers and to avoid damage.

**17** Replace the memory shroud. Tighten the thumbscrews until the memory shroud is well secured and will not shift when the computer is moved.

**18** Replace the computer cover (see "Replacing the Computer Cover" on page 145).

➔ **NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.






**19** Connect your computer and devices to electrical outlets, and turn them on.

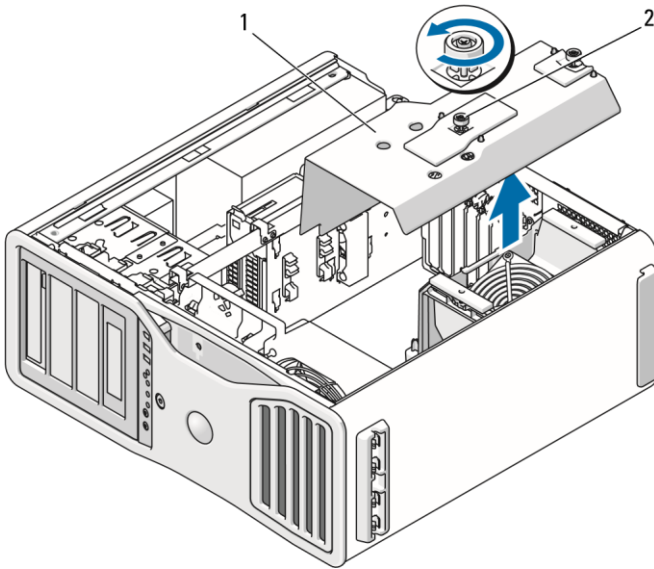
**20** Press <F2> to enter system setup and check the values listed under **Memory Info**.

The computer should have changed the value of **Installed Memory** to reflect the newly installed memory. Verify the new total. If it is correct, skip to step 22.

- 21 If the memory total is incorrect, turn off and disconnect your computer and devices from their electrical outlets.  
  
Return to step 1 of this procedure, but instead of installing new memory, check the installed memory modules to ensure that they are seated properly in their sockets.
- 22 When the **Installed Memory** total is correct, press <Esc> to exit system setup.
- 23 Run the Dell Diagnostics to verify that the memory modules are operating properly. See "Dell Diagnostics" on page 123.

### Removing Memory (With Optional Memory Riser Cards)

-  **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.
  -  **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.
  -  **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.
- 1 Follow the procedures in "Before You Begin" on page 139.
    -  **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.
    -  **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.
  - 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).



1 memory shroud

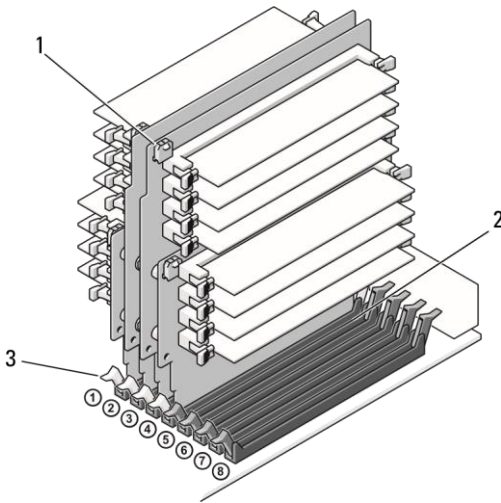
2 thumbscrews (2)

- 3 Loosen the captive thumbscrews that secure the memory shroud and lift it away from the computer.



**CAUTION:** Fully-buffered memory modules may become very hot during normal operation. Ensure that memory modules have had sufficient time to cool before you touch them.

- 4 Disconnect the power cables from memory riser cards 1 and 2.



1 power connectors (4)

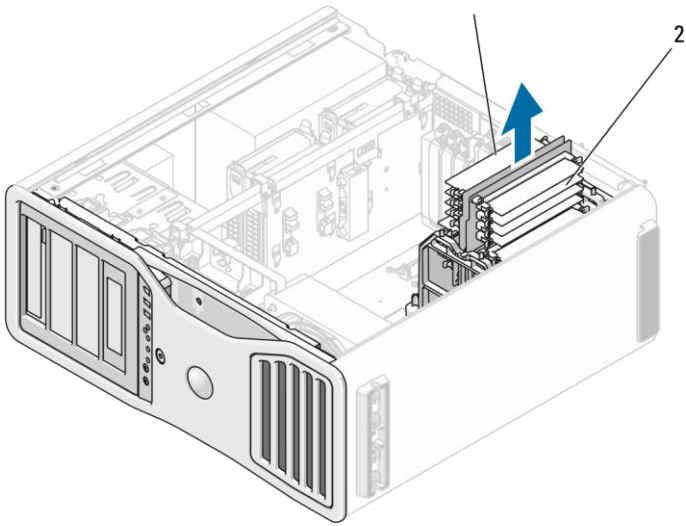
2 memory module connectors (4)

3 securing clips (2)

- 5 Grasp the memory riser card 1 at each corner and lift memory riser card 1 and attached card 2 from the DIMM\_1 and DIMM\_2 memory module connectors on the system board.

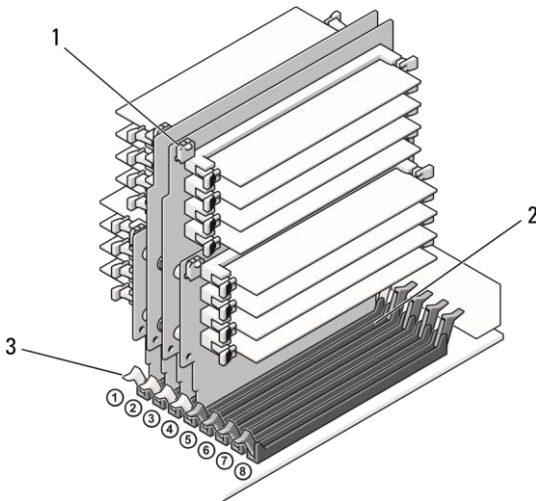
If a card is difficult to remove, gently ease it back and forth to remove it from the connector.

1



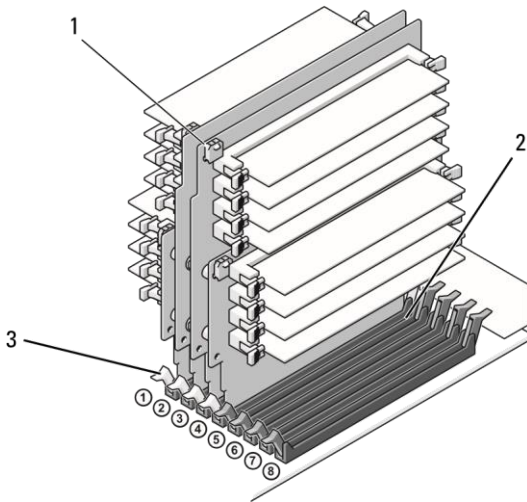
1 memory riser cards 1 and 2    2 memory riser cards 3 and 4

**6** Disconnect the power cables from memory riser cards 3 and 4.









- 1 power connectors
- 2 connector
- 3 securing clips (2)

- 12 Connect the power cables to memory riser cards 3 and 4.
- 13 Ensure that memory riser card 1 is above system-board connector DIMM\_1 and memory riser card 2 is above system-board connector DIMM\_2.

Align the notch on the bottom of each riser card with the crossbar in each system-board connector.

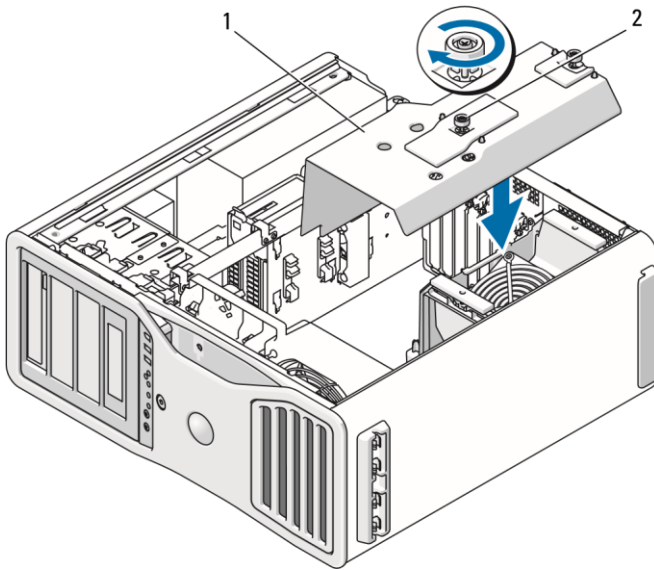
- 14 Insert the riser cards into the connectors until both riser cards snap into position.

**NOTE:** If a memory-riser power cable is not plugged in, the system will not boot. 15

Connect the power cables to memory riser cards 1 and 2.

**NOTICE:** The memory shroud holds the (optional) memory risers in place; its thumbscrews must be sufficiently tight in order to secure the risers and to avoid damage.

- 16 Replace the memory shroud. Tighten the thumbscrews until the memory shroud is well secured and will not shift when the computer is moved.



1 memory shroud

2 thumbscrews (2)

**17** Replace the computer cover (see "Replacing the Computer Cover" on page 145).

**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

**18** Connect your computer and devices to electrical outlets, and turn them on.


## Cards

**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.

**CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.

**NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

## Expansion Card Support

 **NOTE:** To upgrade to or downgrade from a dual-graphics configuration (with the graphics riser card), you will need additional parts that can be ordered from Dell. See "Contacting Dell" on page 287.

### **In a configuration *without* dual graphics and the associated graphics riser card:**

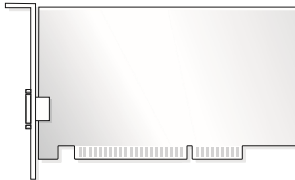
Your Dell™ computer provides the following slots for PCI and PCI Express cards:

- One PCI card slot
- One PCI Express x16 card slot
- Three PCI Express x8 card slots (wired as x4)
- Two PCI-X card slots

### **In a configuration *with* dual graphics and the associated graphics riser card:**

Your Dell™ computer provides the following slots for PCI and PCI Express cards:

- Two PCI Express x16 card slots (reserved for dual-graphics cards)
- One PCI Express x8 card slot (wired as x4)
- Two PCI-X card slots



If you are installing or replacing a PCI, PCI Express, or PCI-X card, see "Installing an Expansion Card" on page 195. If you are removing but not replacing a PCI, PCI Express, or PCI-X card, see "Removing an Expansion Card" on page 202.

Before installing a card, see the documentation that came with the card for information on configuring the card, making internal connections, or otherwise customizing it for your computer. If you are replacing a card, uninstall the existing driver for the card.

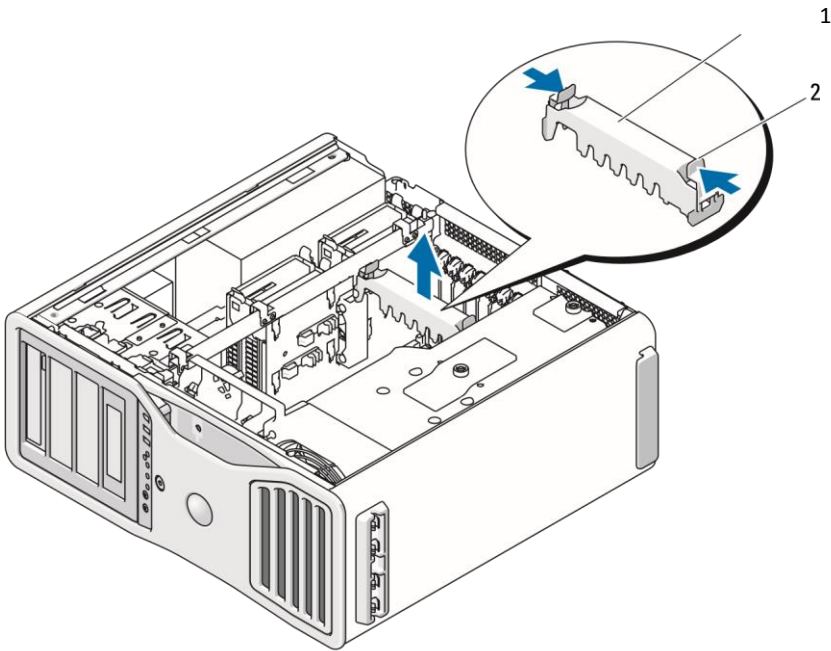
## Installing an Expansion Card

- 1 Follow the procedures in "Before You Begin" on page 139.

**⚠ CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

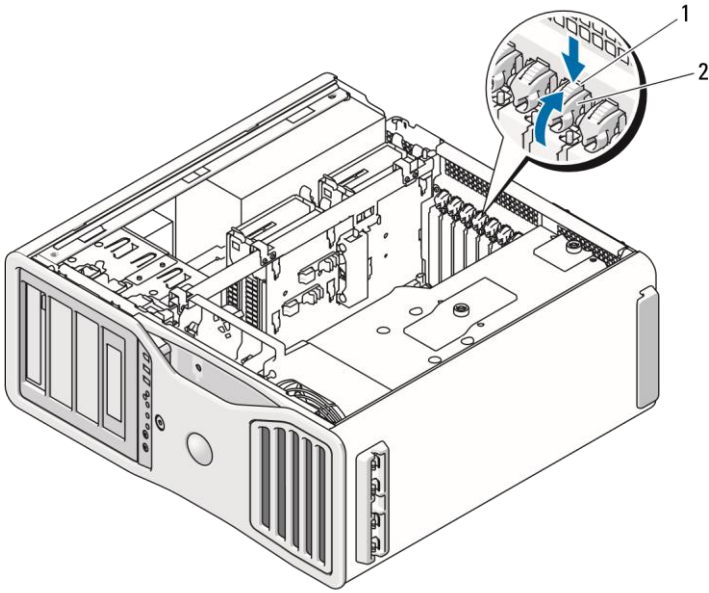
**⚠ CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Press the tabs on either end of the card retention device and lift to remove it from the computer.



1 card retention device      2 tab

- 4 Press down the tab on the top of the card retainer at the appropriate card slot and pivot the card retainer back through the chassis wall.



1 release tab

2 card retainer

- 5 If you are installing a new card, remove the filler bracket to create a cardslot opening. Then continue with step 7.



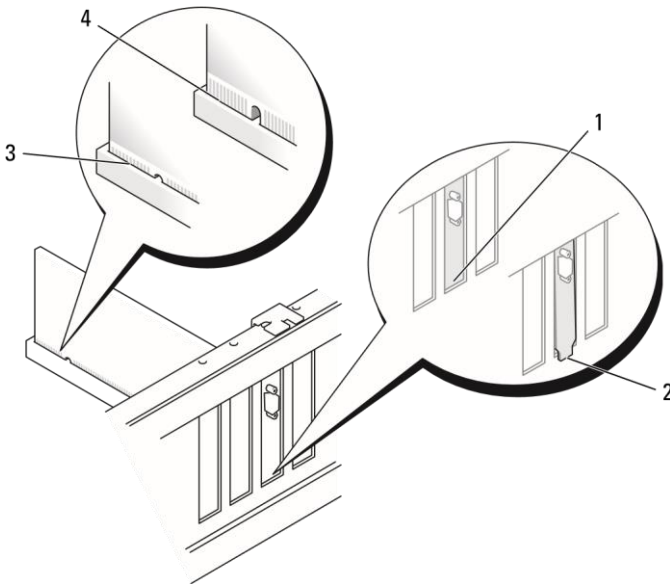
**NOTICE:** Ensure that you release the securing tab to unseat the card. If the card is not removed correctly, the system board may be damaged.

- 6 If you are replacing a card that is already installed in the computer, remove the card:
  - a If necessary, disconnect any cables connected to the card.
  - b If the card is full-length, press the release tab on the end of the alignment guides on the fan bracket.
  - c If the connector has a release tab, press the release tab as you grasp the card by its top corners, and ease it out of its connector.
- 7 Prepare the card for installation.

See the documentation that came with the card for information on configuring the card, making internal connections, or otherwise customizing it for your computer.

**⚠ CAUTION:** Some network adapters automatically start the computer when they are connected to a network. To guard against electrical shock, be sure to unplug your computer from its electrical outlet before installing any cards.


- 8 If the card is full-length, align it between the plastic card guides on the card fan.
- 9 Position the card so that it is aligned with the slot and the securing tab (if present) is aligned with the securing slot.
- 10 Place the card in the connector and press down firmly. Ensure that the card is fully seated in the slot  
If there is a release tab on the card slot, pull the release tab.

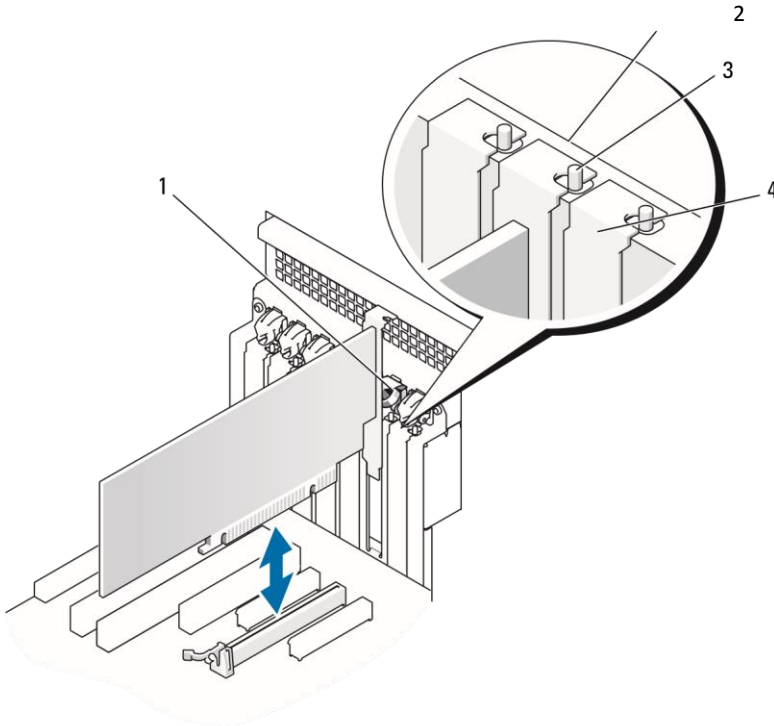


- |   |                     |   |                                |
|---|---------------------|---|--------------------------------|
| 1 | bracket within slot | 2 | bracket caught outside of slot |
| 3 | card fully seated   | 4 | card not fully seated          |

- 11 Before you rotate the card retainer back into place, ensure that:
  - The tops of all cards and filler brackets are flush with the alignment bar.

- The notch in the top of each card or filler bracket fits around the alignment guide.

 **NOTE:** For extra security, remove the alignment guide (an upside-down screw) and screw it in right side up to secure a card.



1 card retainer


2 alignment bar

3 alignment guide

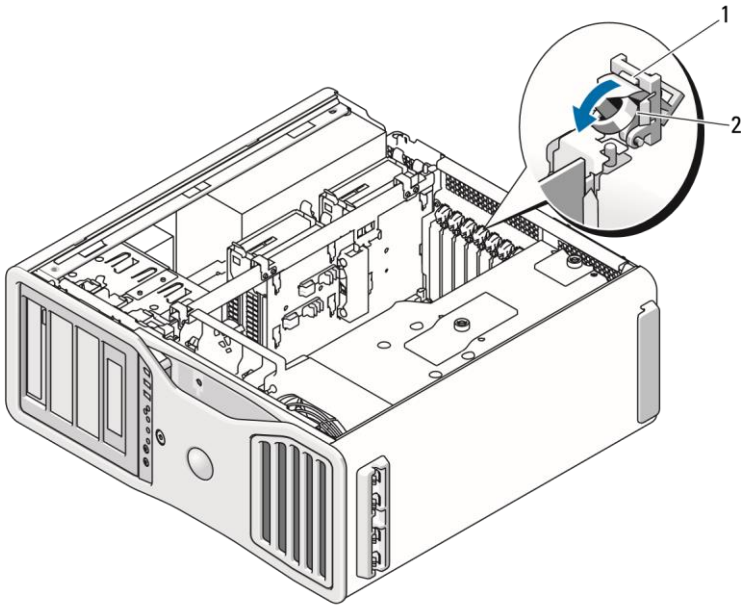
4 filler bracket

For extra security, remove the alignment guide (an upside-down screw) and screw it in right side up to secure a card.

**12** Rotate the card retainer until it snaps into place.

 **NOTICE:** Do not route card cables behind the cards. Cables routed behind the cards could cause damage to the equipment.

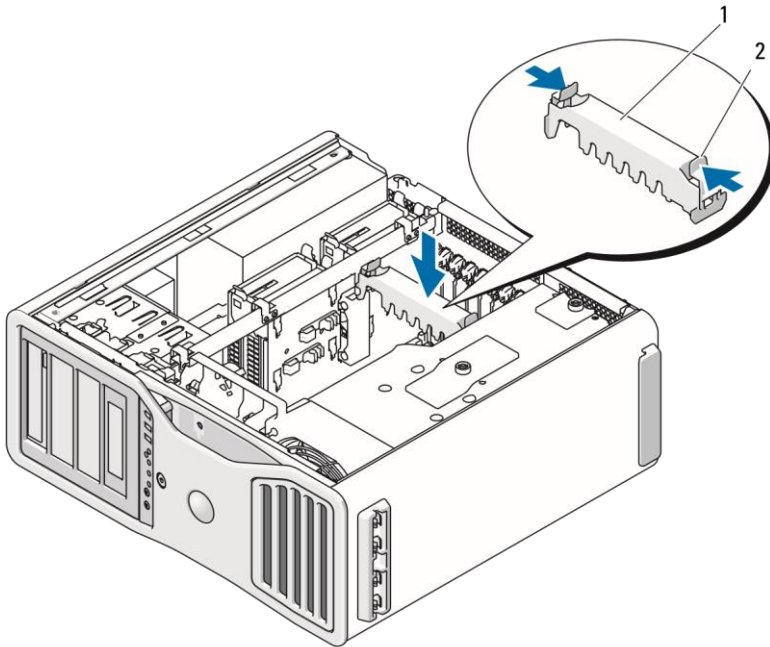




1 release tab

2 card retainer

- 13** Connect any cables that should be attached to the card.  
See the documentation for the card for information about the card's cable connections.
- 14** Press the card retention device back into its original position; push it down until it clicks into place.



1 card retention device

2 tab

**15** Ensure that all connectors are properly cabled and firmly seated.

**▶ NOTICE:** To connect a network cable, first plug the cable into the network device and then plug the cable into the computer.

**16** Replace the computer cover (see "Replacing the Computer Cover" on page 145), reconnect the computer and devices to electrical outlets, and then turn them on.


**17** If you installed a sound card:


- a Enter system setup, select **Integrated Audio**, and then change the setting to **Off**.
- b Connect external audio devices to the sound card's connectors. Do not connect external audio devices to the microphone, speaker/headphone, or line-in connectors on the back panel.

- 18 If you installed a network adapter card and want to disable the integrated network adapter:
  - a Enter system setup, select **Integrated NIC**, and then change the setting to **Off**.
  - b Connect the network cable to the network adapter cards connectors. Do not connect the network cable to the network connector on the back panel.
- 19 Install any drivers required for the card as described in the card documentation.

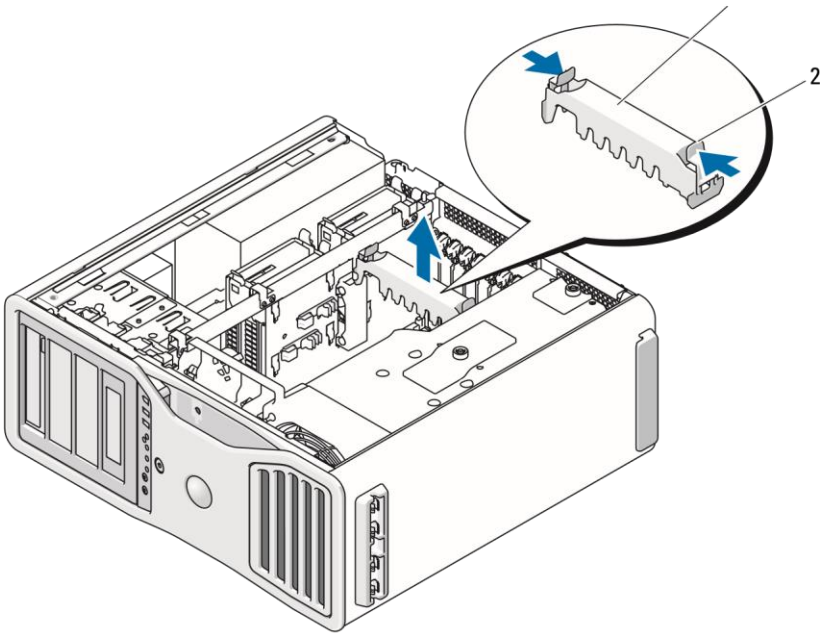
## Removing an Expansion Card

- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

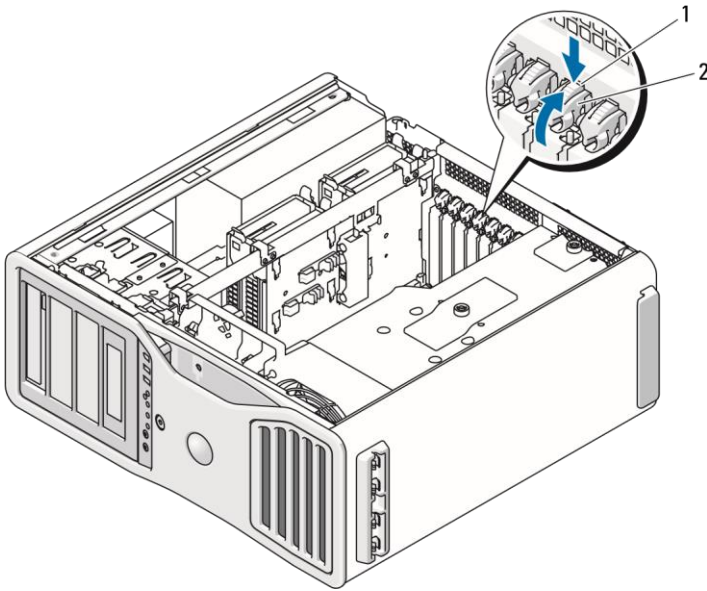
 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).



1 card retention device      2 tab

- 3 Press the tabs on either end of the card retention device and lift to remove it from the computer.
- 4 Press down the tab on the top of the card retainer at the appropriate card slot and pivot the card retainer back through the chassis wall.



1 release tab

2 card retainer

**NOTICE:** Ensure that you release the securing tab to unseat the card. If the card is not removed correctly, the system board may be damaged.

**5** Remove the card:

- a If necessary, disconnect any cables connected to the card.
- b If the card is full-length, press the release tab on the end of the alignment guides on the fan bracket.
- c If the connector has a release tab, press the release tab as you grasp the card by its top corners, and ease it out of its connector.


**6** If you are removing the card permanently, install a filler bracket in the empty card-slot opening.

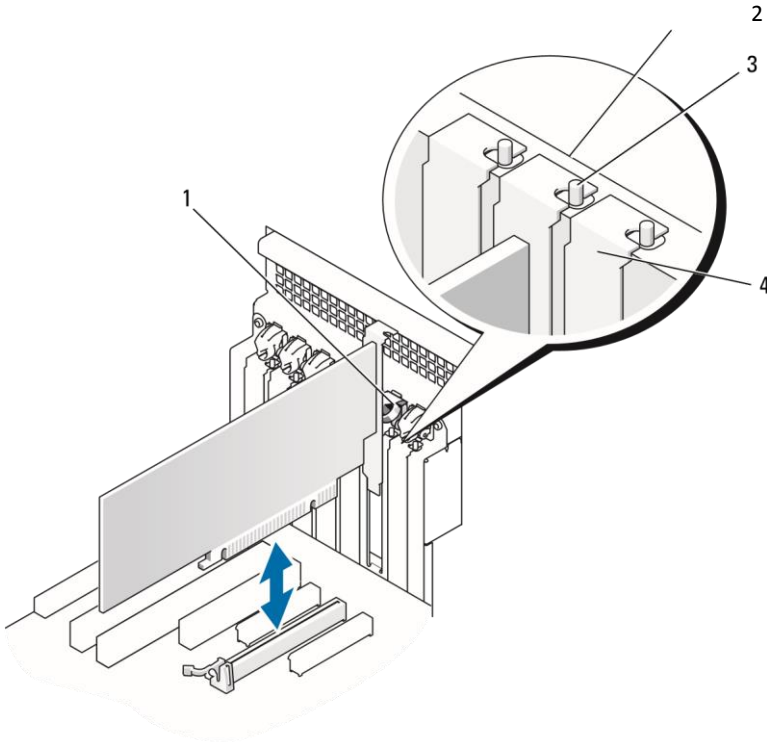
**NOTE:** Installing filler brackets over empty card-slot openings is necessary to maintain FCC certification of the computer. The brackets also keep dust and dirt out of your computer.

**7** Before you rotate the card retainer back into place, ensure that:

- The tops of all cards and filler brackets are flush with the alignment bar.

- The notch in the top of each card or filler bracket fits around the alignment guide.

 **NOTE:** For extra security, remove the alignment guide (an upside-down screw) and screw it in right side up to secure a card.




1 card retainer

2 alignment bar

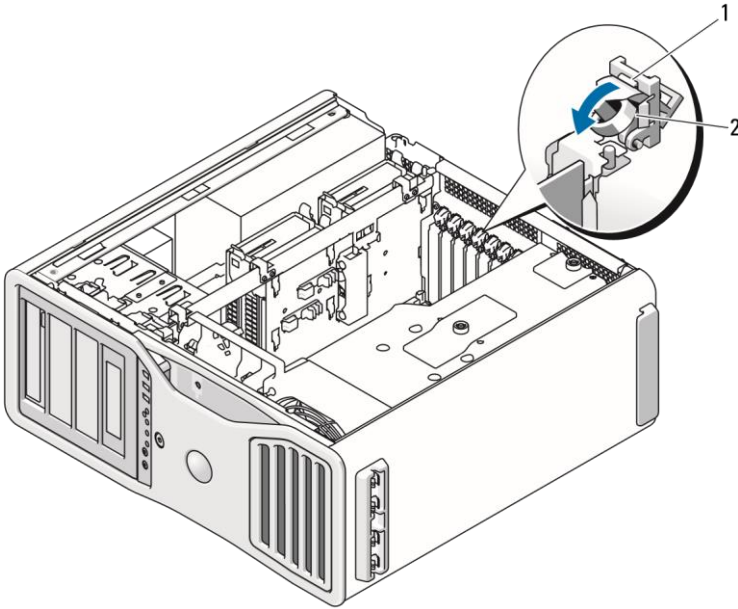
3 alignment guide

4 filler bracket

**NOTE:** For extra security, remove the alignment guide (an upside-down screw) and screw it in right side up to secure a card.

 **NOTICE:** Do not route card cables behind the cards. Cables routed behind the cards could cause damage to the equipment.

- 8** Connect any cables that should be attached to the card.  
See the documentation for the card for information about the card's cable connections.
- 9** Rotate the card retainer back into its original position; push its tip so that its tab clicks into place.

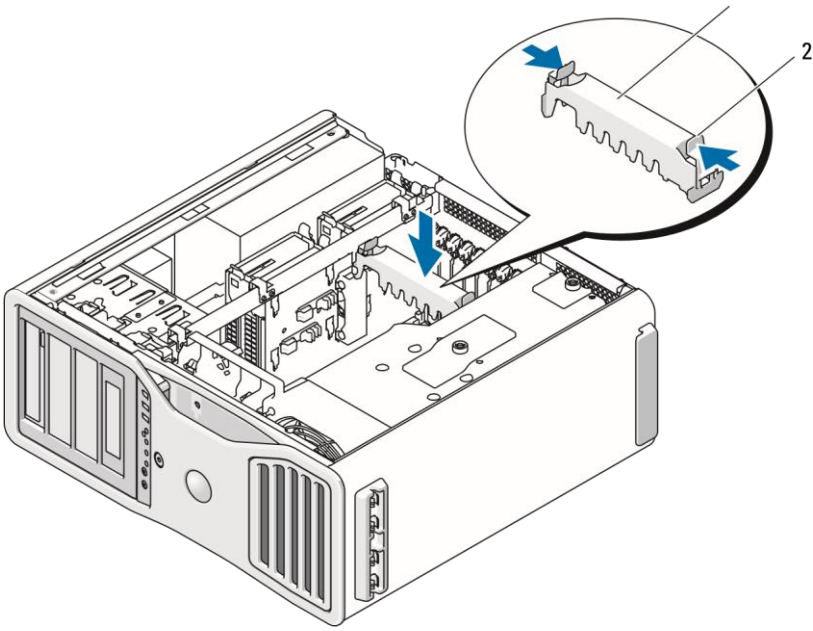


1 release tab

2 card retainer

- 10** Reconnect the data cable to each installed hard drive.
- 11** Reconnect the hard drive power cable to each installed hard drive.
- 12** Ensure that all connectors are properly cabled and firmly seated.
- 13** Press the card retention device back into its original position; push it down until it clicks into place.

1



1 card retention device

2 tab



**NOTICE:** To connect a network cable, first plug the cable into the network device and then plug the cable into the computer.


- 14 Replace the computer cover (see "Replacing the Computer Cover" on page 145), reconnect the computer and devices to electrical outlets, and then turn them on.
- 15 Uninstall the driver for the removed card. See the documentation that came with the card.
- 16 If you removed a sound card:
  - a Enter system setup, select **Integrated Audio**, and then change the setting to **On**.
  - b Connect external audio devices to the audio connectors on the back panel of the computer.
- 17 If you removed a network adapter card:





- a Enter system setup, select **Integrated NIC**, and then change the setting to **On**.
- b Connect the network cable to the network connector on the back panel of the computer.

## Removing a PCI Express Graphics Card from an SLI Configuration

This section covers only those systems where the graphics cards are set up to operate in SLI mode. For removal of any other types of PCI or PCI Express cards, see "Removing an Expansion Card" on page 202.

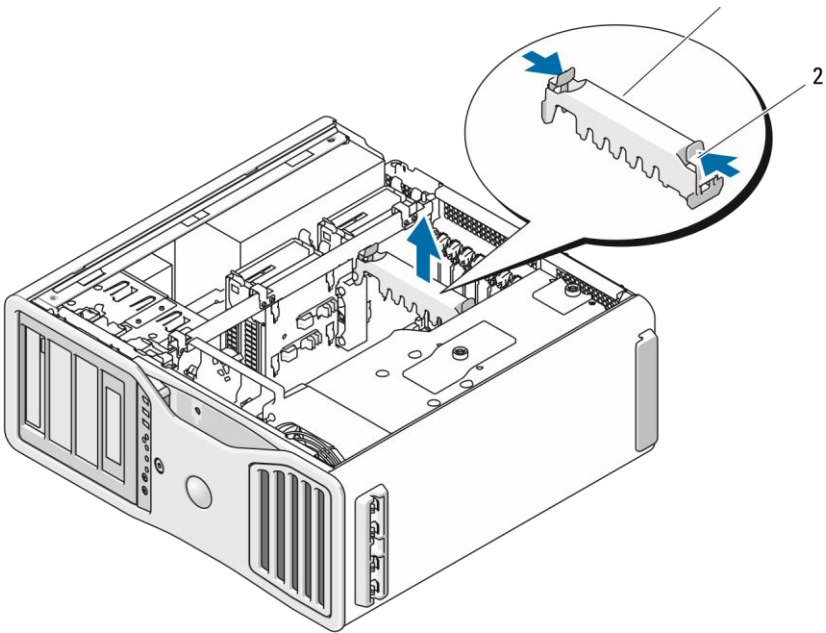
 **NOTE:** To upgrade to or downgrade from an SLI configuration, you will need additional parts that can be ordered from Dell. See "Contacting Dell" on page 287. **1** Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

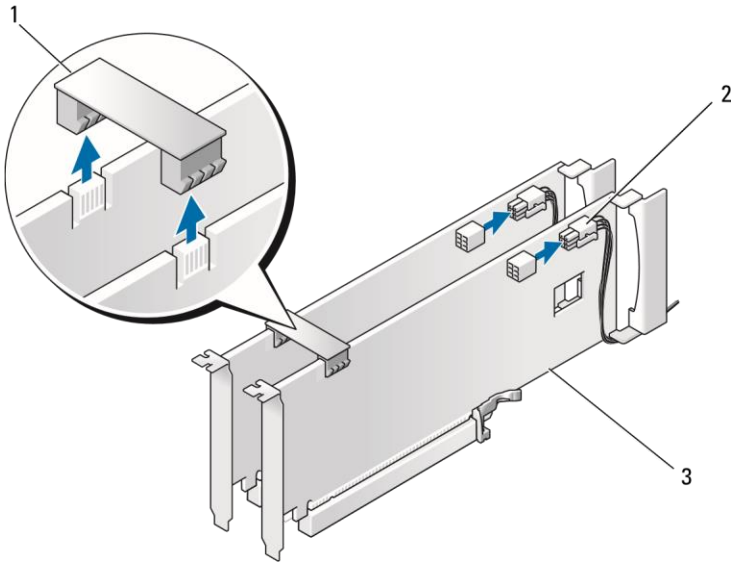
- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).

1



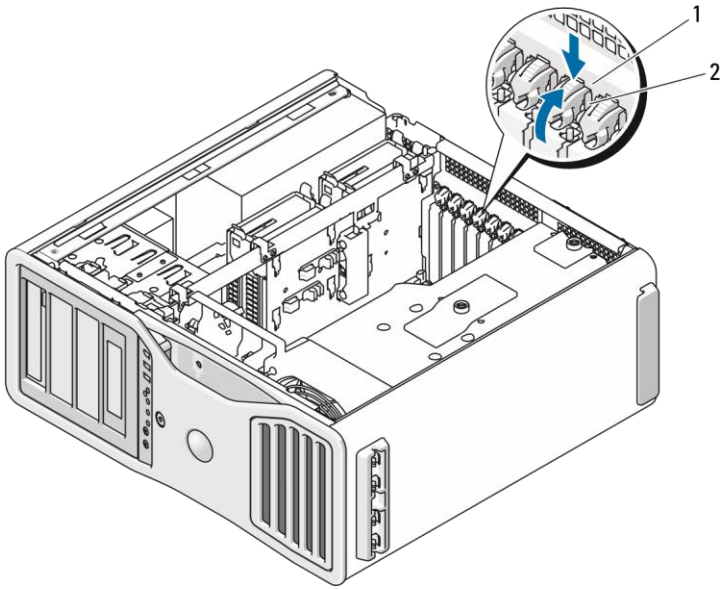
1 card retention device      2 tab

- 3** Press the tabs on either end of the card retention device and lift to remove it from the computer.
- 4** Gently securing both graphics cards with one hand, remove the graphics card bridge (if present) with your other hand by pulling it up and away from the computer. Set it aside.



- 1 graphics card bridge (not present on some dual-graphics configurations)
- 2 power connectors (2) on some dual-graphics configurations)
- 3 dual-PCI Express graphics cards

- 5 Disconnect any cables connected to the card.
- 6 Press down the tab on the top of the card retainer at the appropriate card slot and pivot the card retainer back through the chassis wall.

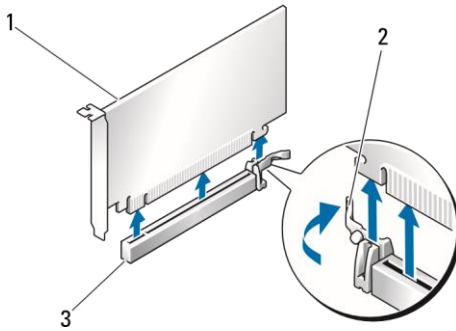


1 release tab

2 card retainer

**7** Remove the card:

- a If necessary, disconnect any cables connected to the card.
- b If the card is full-length, press the release tab on the end of the alignment guides on the fan bracket.
- c If the connector has a release tab, press the release tab as you grasp the card by its top corners, and ease it out of its connector.





1 PCI Express x16 card                      2 securing tab

3 PCI Express x16 card slot


- 8 If you are replacing the card, see "Installing PCI Express Graphics Cards in a Dual Configuration" on page 215.

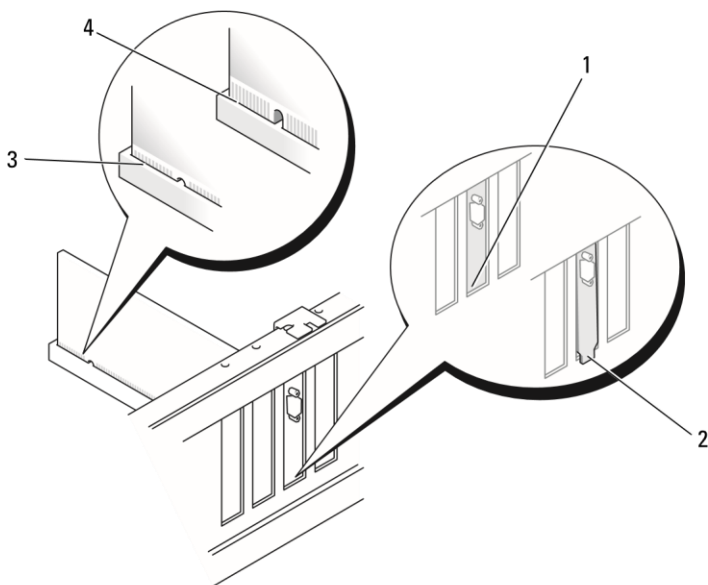
If you are not replacing the card, install a filler bracket in the empty cardslot opening.

 **NOTE:** Installing filler brackets over empty card-slot openings is necessary to maintain FCC certification of the computer. The brackets also keep dust and dirt out of your computer.

 **NOTE:** The graphics card bridge (not present on all dual-graphics configurations) is unnecessary in a single card configuration.

- 9 Before you rotate the card retainer back into place, ensure that:
- The tops of all cards and filler brackets are flush with the alignment bar.
  - The notch in the top of each card or filler bracket fits around the alignment guide.

 **NOTE:** For extra security, remove the alignment guide (an upside-down screw) and screw it in right side up to secure a card.



1 bracket inside of slot

2 bracket caught outside of slot

3 fully seated card

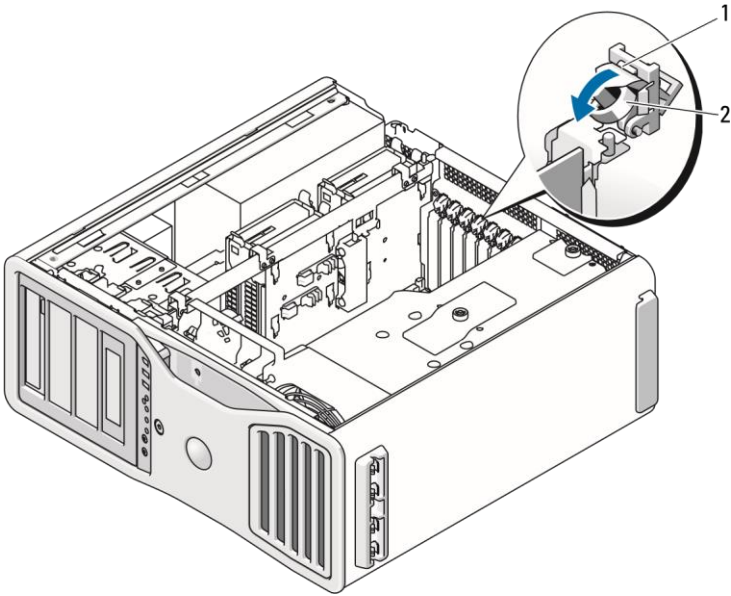
4 not fully seated card

**➔ NOTICE:** Do not route card cables behind the cards. Cables routed behind the cards could cause damage to the equipment.

**10** Connect any cables that should be attached to the card.

See the documentation for the card for information about the card's cable connections.

**11** Rotate the card retainer back into its original position; push its tip so that its tab clicks into place.

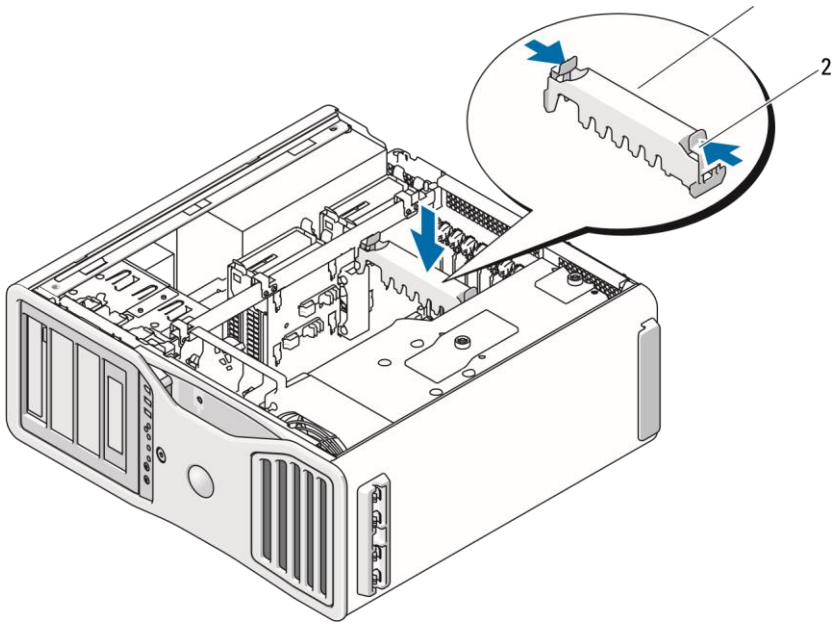


1 release tab

2 card retainer

**12** Press the card retention device back into its original position; push it down until it clicks into place.

1



1 card retention device

2 tab

**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug the cable into the computer.

- 13 Replace the computer cover (see "Replacing the Computer Cover" on page 145), reconnect the computer and devices to electrical outlets, and then turn them on.

### Installing PCI Express Graphics Cards in a Dual Configuration

**NOTE:** To upgrade to or downgrade from a dual-graphics configuration, you will need additional parts that can be ordered from Dell. See "Contacting Dell" on page 287.

This section regards dual configurations of PCI Express graphics cards only. For installation of any other type of PCI or PCI Express cards, see "Installing an Expansion Card" on page 195.

One PCI card slot and two PCI Express x8 (wired as x4) card slots are not available for use if a graphics riser card is installed for the dual-graphics configuration.



Instead, an additional PCI Express x16 slot is available for the second card in the dual-graphics configuration. If you are upgrading from or downgrading to a single graphics to a dual-graphics configuration, you will need additional parts. Contact Dell to obtain optional upgrade or downgrade parts (see "Contacting Dell" on page 287).

See "System Board Components" on page 27 to locate the PCI Express x1 card slot. To remove a PCI Express card, see "Removing an Expansion Card" on page 202.

- 1 Follow the procedures in "Before You Begin" on page 139.

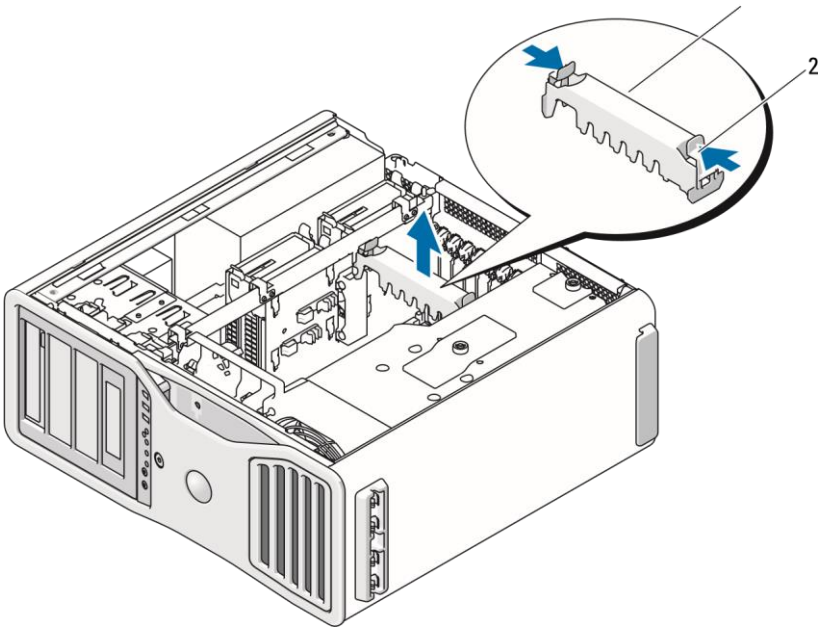


**CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.



**CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

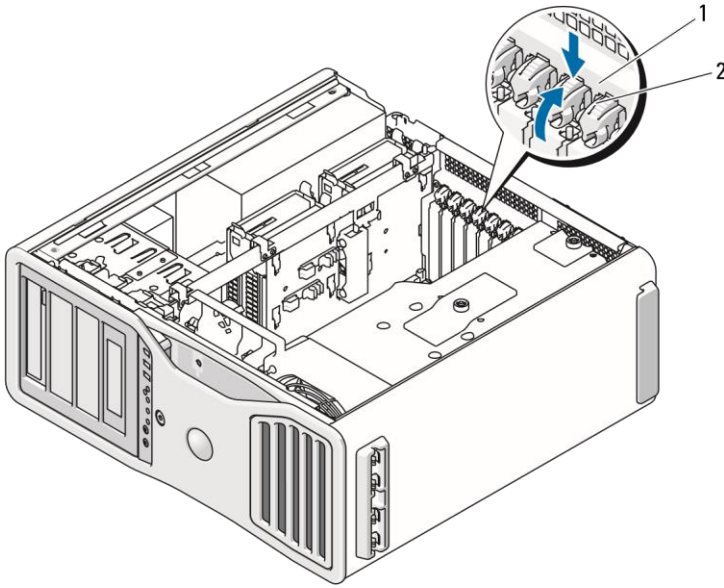
- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).



1 card retention device

2 tab

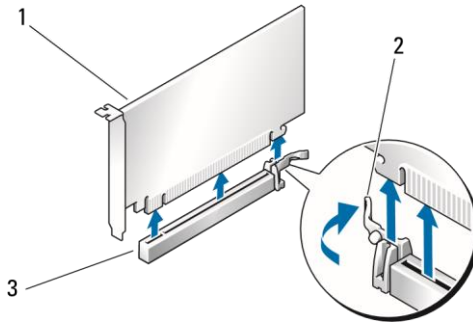
- 3** Press the tabs on either end of the card retention device and lift to remove it from the computer.
- 4** Press down the tab on the top of the card retainer at the appropriate card slot and pivot the card retainer back through the chassis wall.



1 release tab

2 card retainer

- 5 If you are replacing a card, see "Removing a PCI Express Graphics Card from an SLI Configuration" on page 208.
- 6 Prepare the card for installation.  
See the documentation that came with the card for information on configuring the card, making internal connections, or otherwise customizing it for your computer.
- 7 If the card is full-length, align it between the plastic card guides on the card fan.
- 8 Position the card so that it is aligned with the slot and the securing tab (if present) is aligned with the securing slot.



- 1 PCI Express x16 card                      2 securing tab  
3 PCI Express x16 card slot

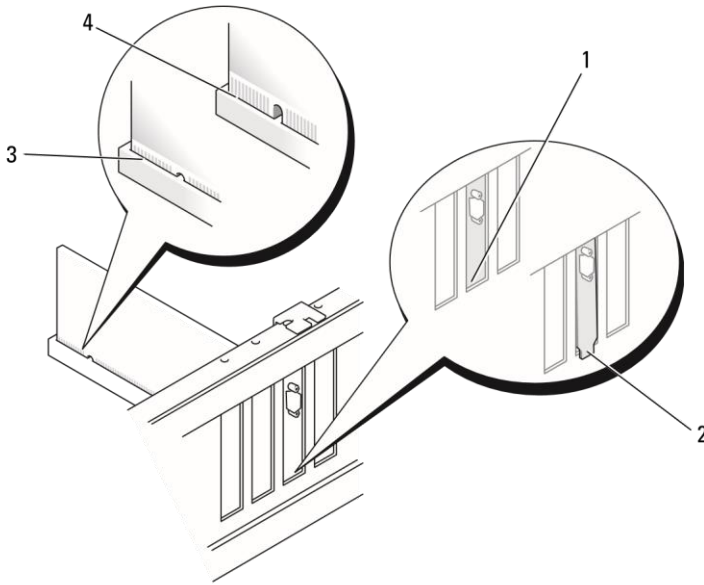
**➔ NOTICE:** Ensure that you release the securing tab to seat the card. If the card is not installed correctly, you may damage the system board.

**9** Gently pull the securing tab (if present) and place the card in the connector. Press down firmly and ensure that the card is fully seated in the slot.

**10** Before you rotate the card retainer back into place, ensure that:

- The tops of all cards and filler brackets are flush with the alignment bar.
- The notch in the top of each card or filler bracket fits around the alignment guide.

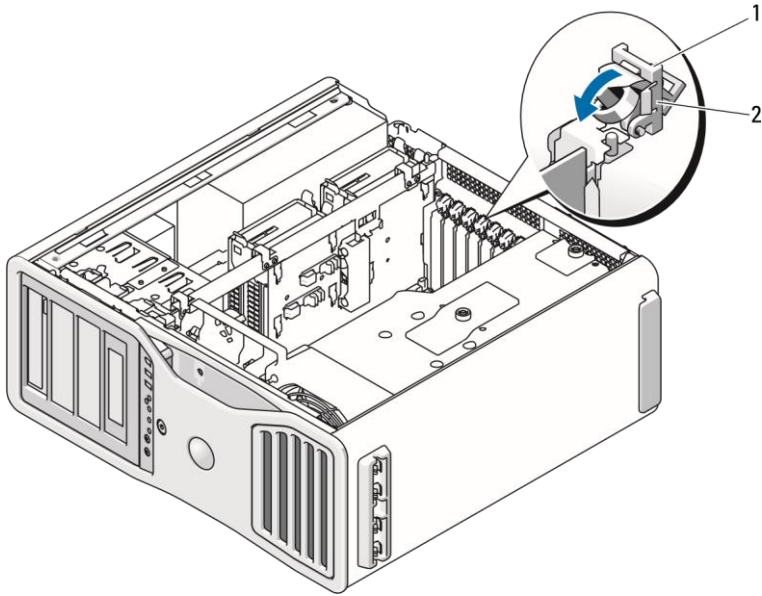
**🔩 NOTE:** For extra security, remove the alignment guide (an upside-down screw) and screw it in right side up to secure a card.



- 1 bracket inside of slot                      2 bracket caught outside of slot  
 3 fully seated card      4 not fully seated card

**NOTICE:** Do not route card cables behind the cards. Cables routed behind the cards could cause damage to the equipment.

- 11** Connect any cables that should be attached to the card.  
 See the documentation for the card for information about the card's cable connections.
- 12** Rotate the card retainer back into its original position; push its tip so that its tab clicks into place.

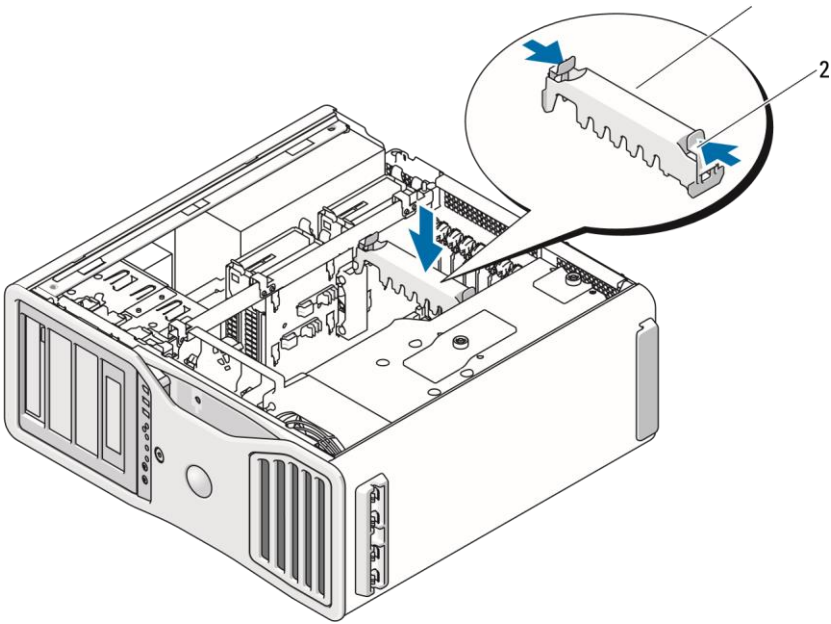


1 release tab

2 card retainer

**13** Press the card retention device back into its original position; push it down until it clicks into place.

1



1 card retention device

2 tab

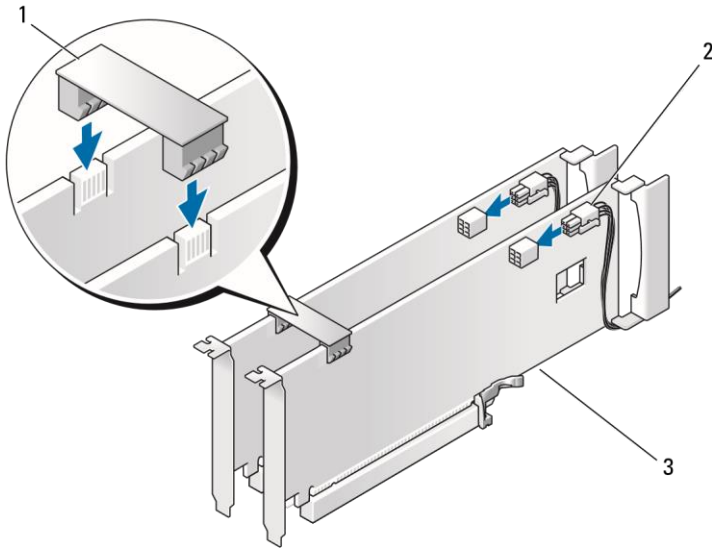


**NOTICE:** An incorrectly attached graphics power cable may result in degraded graphics performance.

- 14 Connect the power cable to the power connector on the card.

For information about the card cable connections, see the documentation that came with the card.

- 15 Attach the graphics card bridge (if required for your dual-graphics configuration), pressing firmly so that it completely covers the connector tabs.



- 1 graphics card bridge (not present on some dual-graphics configurations)
- 2 power connectors (2) on some dual-graphics configurations)
- 3 dual-PCI Express graphics cards

**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug the cable into the computer.

- 16 Replace the computer cover (see "Replacing the Computer Cover" on page 145), reconnect the computer and devices to electrical outlets, and then turn them on.

### Removing the Optional Graphics Riser Card

**NOTE:** To upgrade to or downgrade from a dual-graphics configuration (with the graphics riser card), you will need additional parts that can be ordered from Dell. See "Contacting Dell" on page 287.

- 1 Follow the procedures in "Before You Begin" on page 139.

**CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid

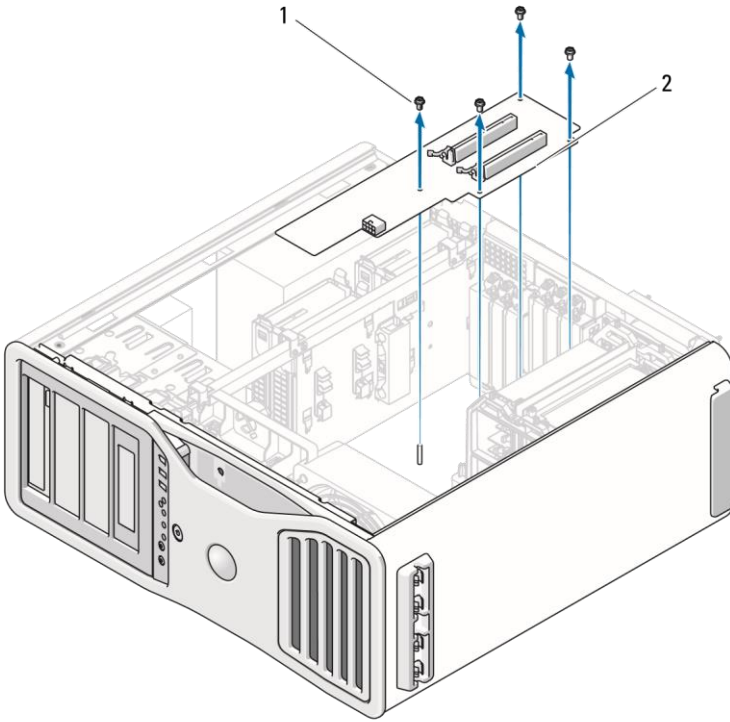


bending over while lifting. See your Product Information Guide for other important safety information.



**CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Replacing the Computer Cover" on page 145).
- 3 If a graphics riser card is installed, remove it:
  - a Remove its four screws. **b**  
Disconnect its power cable.
  - c Move it slightly up and to the right at an angle to free it from the card fan and the memory-riser support structure.
  - d Set the riser aside.



1 screws

2 graphics riser card

## Replacing the Optional Graphics Riser Card

**NOTE:** To upgrade to or downgrade from a dual-graphics configuration (with the graphics riser card), you will need additional parts that can be ordered from Dell. See "Contacting Dell" on page 287.

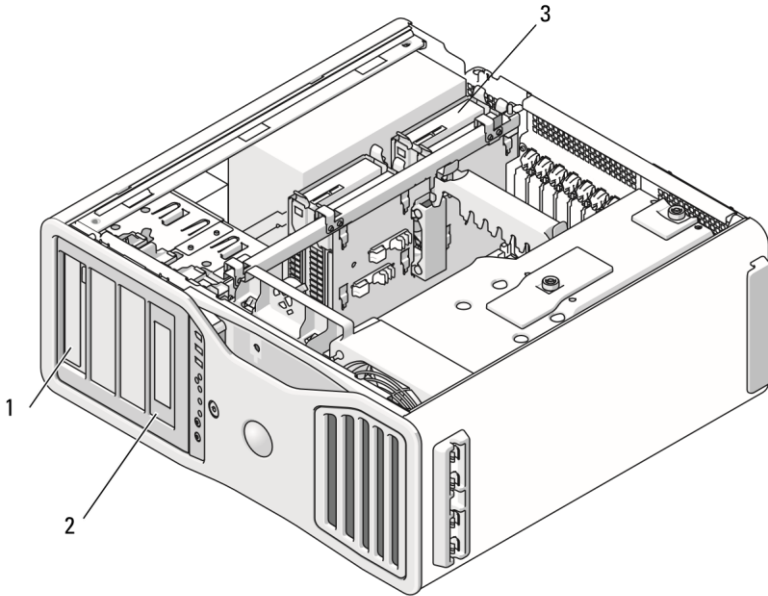
Follow the steps for graphics riser card removal in reverse order.

## Drives

Your computer supports:

- Up to four SAS (serial-attached SCSI) hard drives and one serial ATA (SATA) hard drive, or up to five SATA hard drives

- Up to three optical drives (if no floppy drive, Media Card Reader, or hard drive is installed in a 5.25-inch bay)
- One floppy drive
- One Media Card Reader



- |   |  |
|---|--|
| <p>1 four 5.25-inch drive bays (can hold an optical drive, floppy drive, Media Card Reader, or SATA hard drive in a special drive case)</p> | <p>2 special floppy drive/Media Card Reader drive panel plate and insert</p> |
|---|--|

**NOTE:** The 5.25-inch Media Card Reader/floppy drive carrier is not interchangeable with the hard drive carrier.

- 3 four hard-drive bays (can hold SATA or SAS hard drives)

### General Drive Installation Guidelines

When you install a drive, you connect two cables—a DC power cable from the power supply and a data cable—to the back of the drive. The other end of the data cable

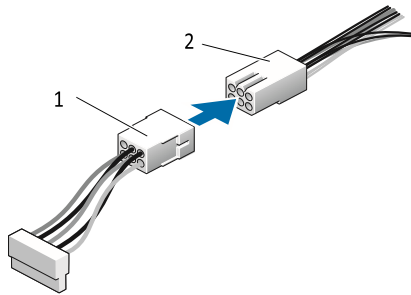
will connect to either an expansion card or to the system board. Most connectors are keyed for correct insertion.

### General Drive Installation Guidelines

**NOTICE:** If metal shields are present in your computer configuration, they must be installed at all times while your computer is in use or your computer may not function properly.

When you install a drive, you connect two cables—a DC power cable from the power supply and a data cable—to the back of the drive. The other end of the data cable will connect to either an expansion card or to the system board. Most connectors are keyed for correct insertion; that is, a notch or a missing pin on one connector matches a tab or a filled-in hole on the other connector.

### Power Cable Connectors

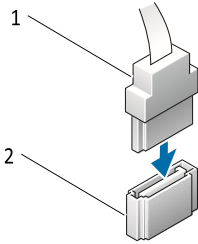


1 power cable

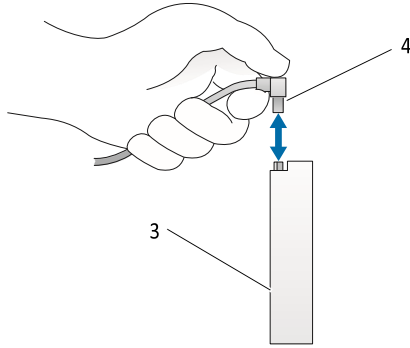
2 power input connector

When connecting a SAS or SATA cable, hold the cable by the connector at each end and press firmly into the connector. When disconnecting a SAS or SATA cable, hold the cable by the connector at each end and pull until the connector detaches.

### SATA Data Cable Connectors

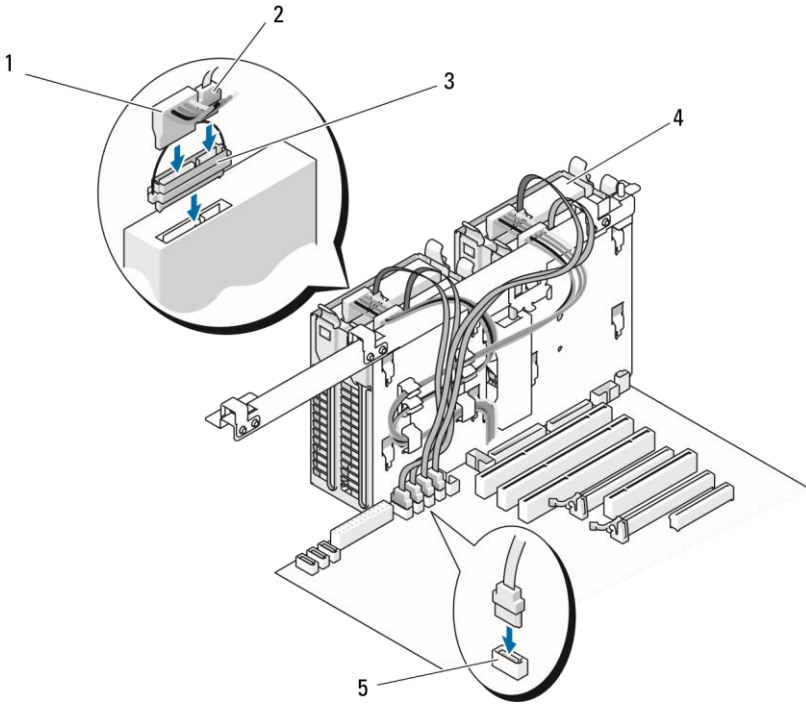


- 1 SATA data cable
- 2 SATA connector on system board



- 3 SATA drive
- 4 SATA data cable

## SAS Data Cable Connectors



1 power cable

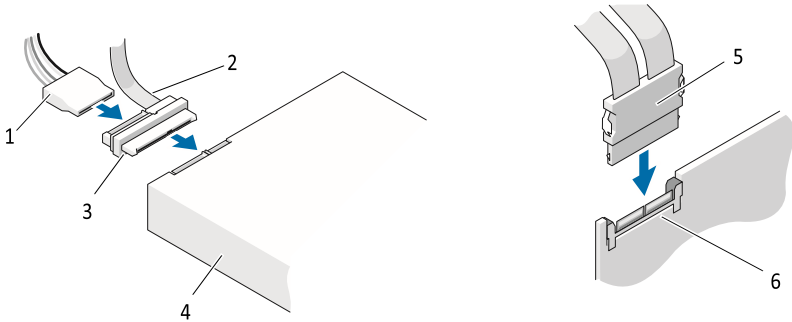
3 interposer

5 HDD connector

2 SAS data cable

4 SAS drive

## Controller Card Data Cable Connectors



- |                      |  |
|----------------------|--|
| 1 SAS data connector | 2 power connector                          |
| 3 interposer         | 4 SAS drive                                |
| 5 SAS connector      | 6 optional PCI Express SAS controller card |

## Hard Drive

**NOTICE:** Do not attempt to install a SAS hard drive in a 5.25-inch drive bay. These drive bays will only support a SATA hard drive, an optical drive, a floppy drive, or a Media Card Reader.

**NOTICE:** If one SATA drive and any SAS drives are installed, the SATA drive must be the boot drive and should be installed in a 5.25-inch drive bay.


**NOTICE:** It is recommended that you only use SAS cables purchased from Dell. Cables purchased elsewhere are not guaranteed to work with Dell computers. Drive numbering is marked upon the chassis beside the hard-drive bays.


## Removing a Hard Drive (Hard Drive Bays 1-4)

**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the Product Information Guide.

**CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before removing the cover.

- 1 If you are replacing a hard drive that contains data that you want to keep, back up your files before you begin this procedure.
- 2 Follow the procedures in "Before You Begin" on page 139.

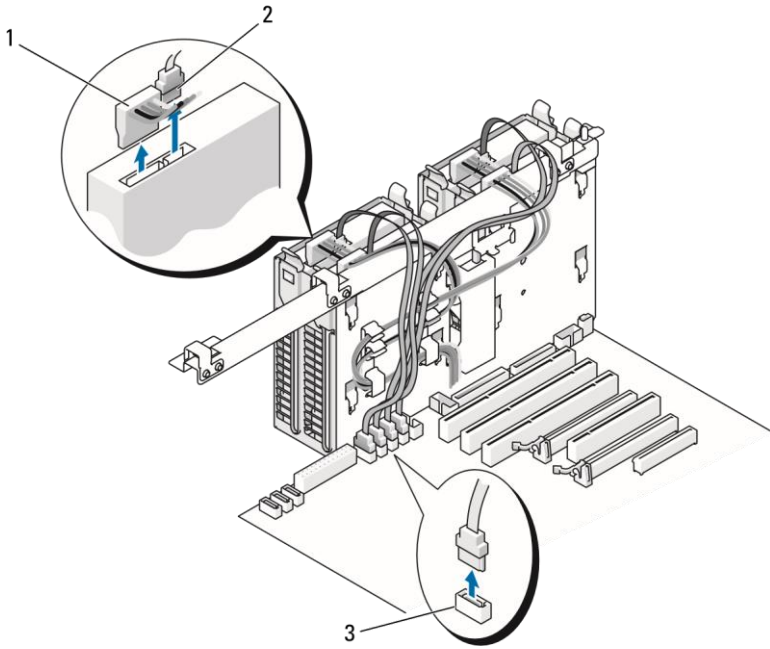
 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 3 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 4 Disconnect the power cable from the hard drive.
- 5 Disconnect the data cable from the hard drive.
- 6 If you are using a add-in storage controller card, ensure that the data cable is held by cable clips, if available on your system, where it will not be pinched or crimped.

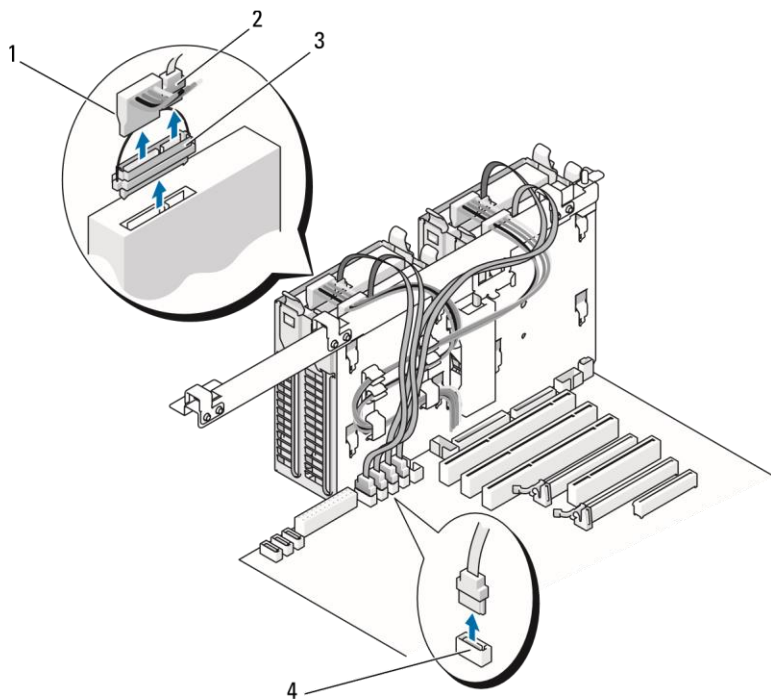
Otherwise, remove the other end of the data cable from the system board.





- 1 power cable
- 3 HDD connector

- 2 data cable



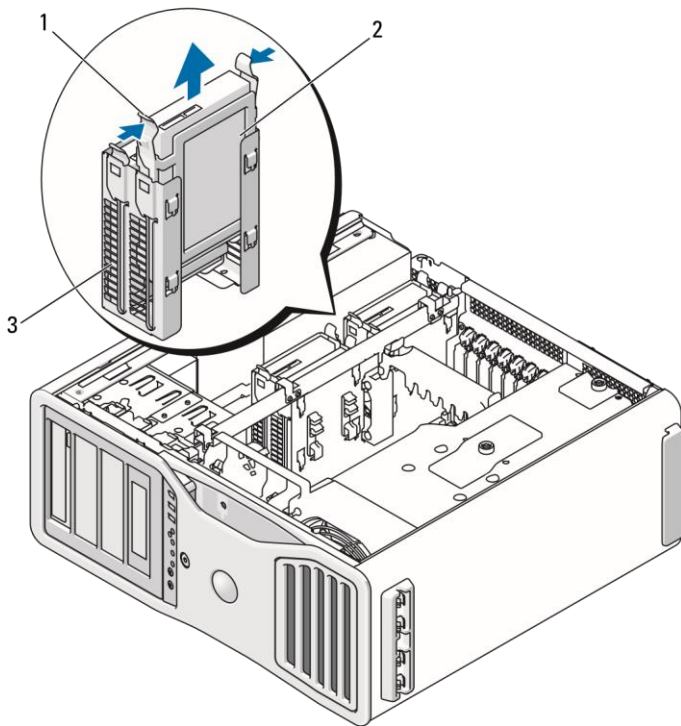
1 power cable

2 data cable

3 SAS interposer connector

4 HDD connector

- 7 Press the blue tabs on each side of the hard-drive bracket toward each other and slide the drive up and out of the hard-drive bay.



- 1 blue tabs (2)                      2 hard drive  
3 hard-drive bay

- 8 Ensure that all connectors are properly cabled and firmly seated.  
9 Replace the computer cover (see "Replacing the Computer Cover" on page 145).

**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

- 10 Connect the computer and devices to electrical outlets, and turn them on.

### Installing a Hard Drive (Hard Drive Bays 1-4)

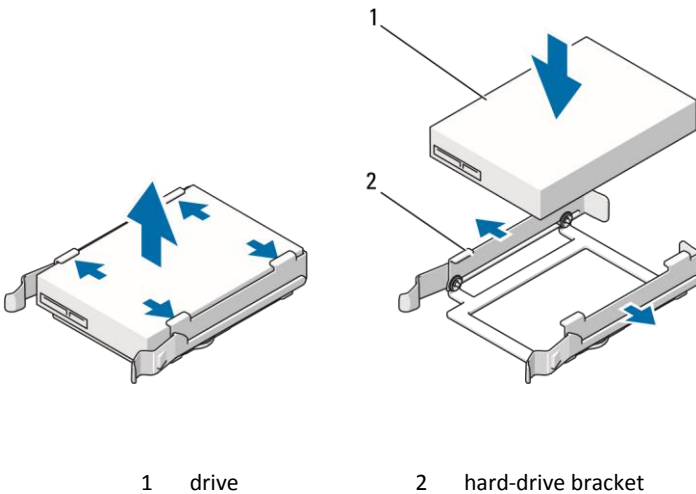
**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the Product Information Guide.

**⚠ CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before removing the cover.

- 1 Unpack the replacement hard drive, and prepare it for installation.
- 2 Check the documentation for the hard drive to verify that the drive is configured for your computer.

**➡ NOTE:** If a hard-drive bracket is still installed in the inside of the hard-drive bay, remove the bracket before you install the new hard drive.

- 3 If your replacement hard drive does not have the hard-drive bracket attached, remove the bracket from the old drive by unsnapping it from the drive. Snap the bracket onto the new drive.

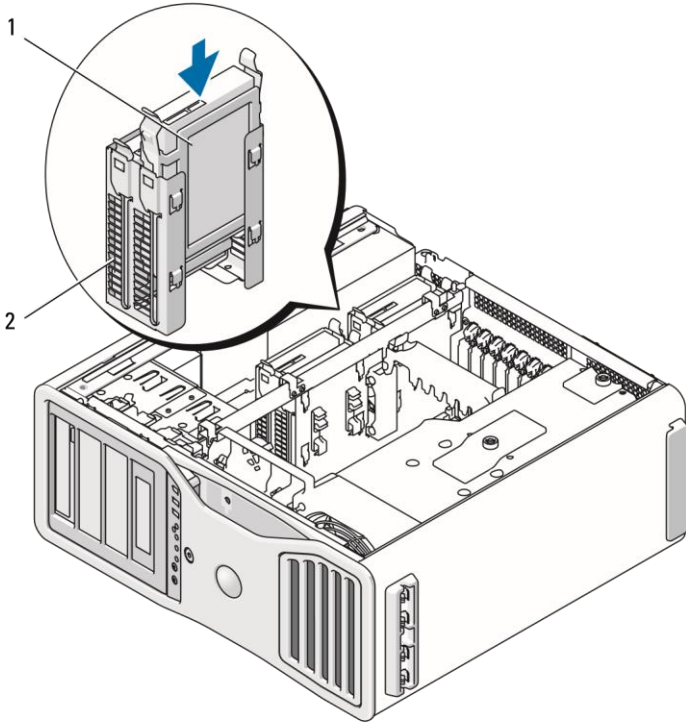


- 4 Follow the procedures in "Before You Begin" on page 139.

**⚠ CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

**⚠ CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

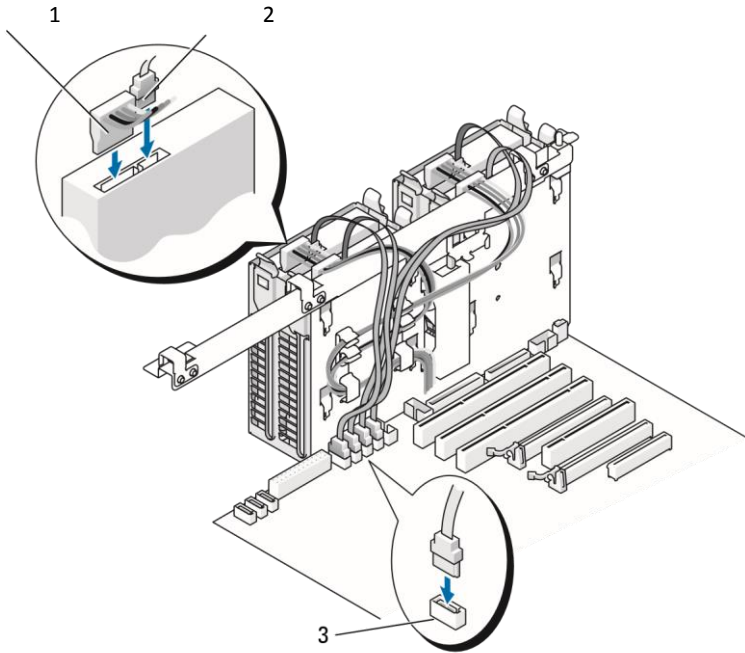
- 5 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 6 Verify that the hard-drive bay is empty. If there is a hard drive bracket installed, remove it: press its tabs toward each other and pull it out of the bay. If there is a drive installed in the bay, remove it (see "Removing a Hard Drive (Hard Drive Bays 1-4)" on page 230).
- 7 Slide the hard drive into the hard-drive bay until it clicks securely into place.



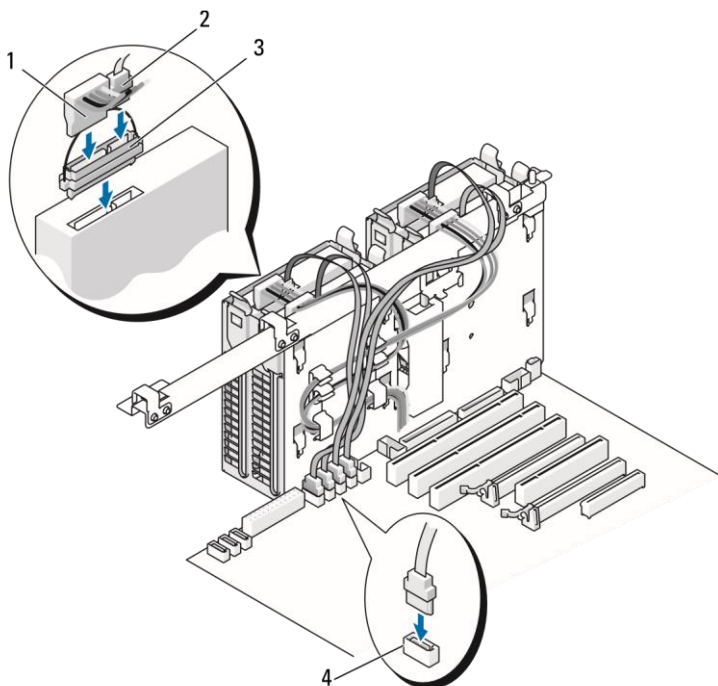
1 hard drive                      2 hard drive bay

- 8 Connect the power cable to the drive.
- 9 Connect one end of the data cable to the hard drive.
- 10 If you are using a add-in storage controller card, the other end of the data cable is attached to the add-in storage controller card. Otherwise, connect the data cable to a HDD connector on the system board.

**NOTICE:** Ensure that you connect hard drives only to connectors on the system board that are marked HDD. Do not connect hard drives to connectors labeled SATA. (The exception is a SATA boot drive in a five-drive configuration.)



- 1 power cable
- 2 data cable
- 3 HDD connector



- |   |                          |   |               |
|---|--------------------------|---|---------------|
| 1 | power cable              | 2 | data cable    |
| 3 | SAS interposer connector | 4 | HDD connector |


- 11 Ensure that all connectors are properly cabled and firmly seated.
- 12 Replace the computer cover (see "Replacing the Computer Cover" on page 145).


**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

- 13 Connect the computer and devices to electrical outlets, and turn them on.  
See the documentation that came with the drive for instructions on installing any software required for drive operation.
- 14 If the drive you just installed is the primary drive, insert bootable disc into drive A.


- 15 Turn on the computer.
- 16 Enter system setup, and update the appropriate **Drive** option (see "System Setup" on page 75).
- 17 Exit system setup, and reboot the computer.
- 18 Partition and logically format your drive before you proceed to the next step. See the documentation for your operating system for instructions.
- 19 Test the hard drive by running the Dell Diagnostics. See "Dell Diagnostics" on page 123.
- 20 If the drive you just installed is the primary drive, install your operating system on the hard drive.


### Removing a Fifth SATA Hard Drive (Optional)

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the Product Information Guide.

 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before removing the cover.

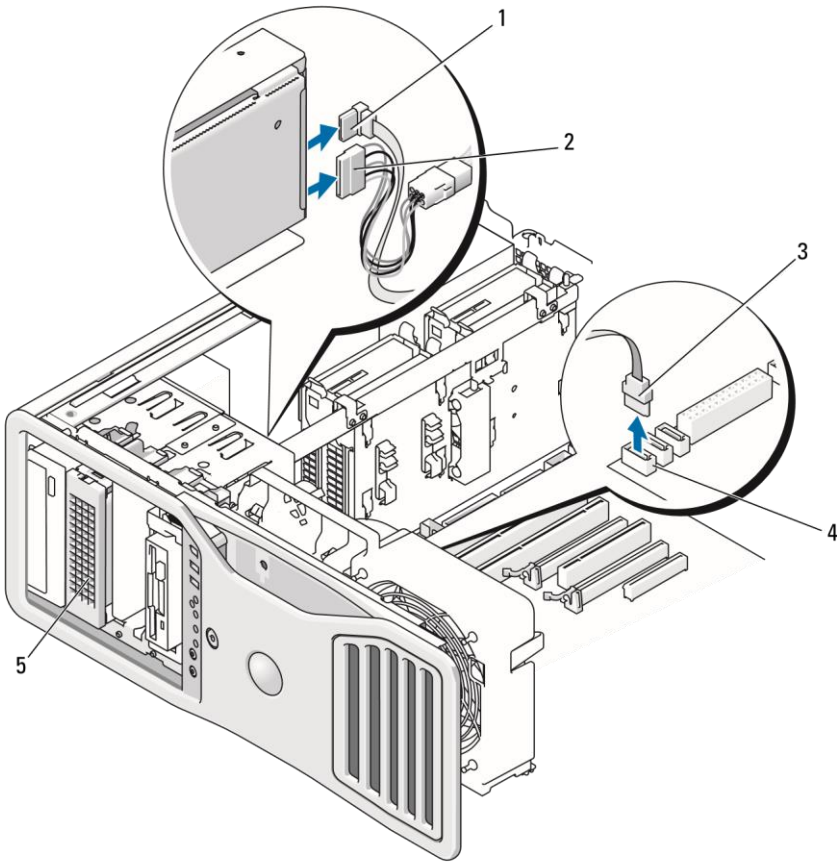
- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Remove the drive panel (see "Removing the Drive Panel" on page 246).
- 4 Disconnect the power cable from the back of the hard drive.
- 5 Disconnect the data cable from the back of the hard drive and from the connector on the system board.

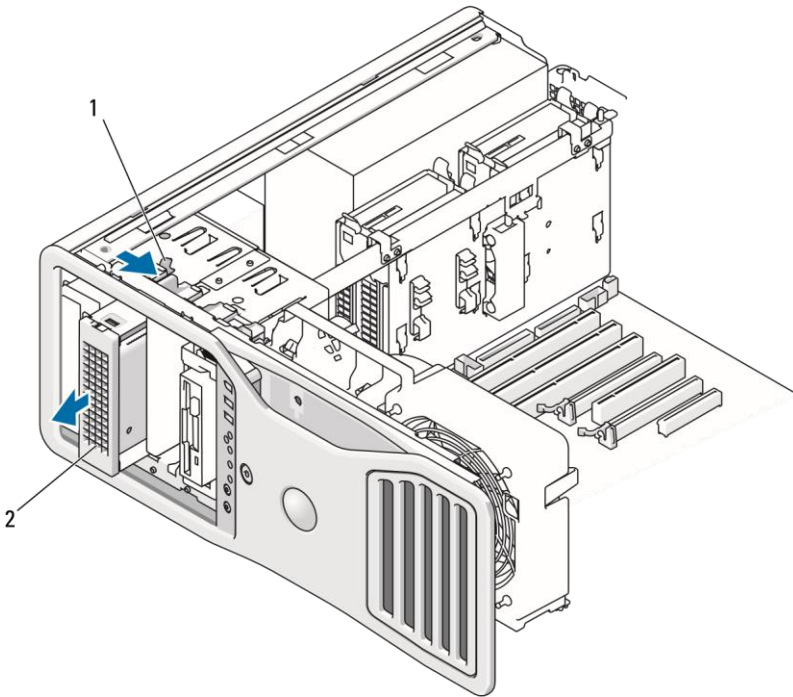




- 1 data cable
- 2 power cable
- 3 data cable
- 4 SATA connector on system board
- 5 optional SATA hard drive

**NOTE:** The optional fifth SATA hard drive can be installed in any of the 5.25-inch drive bays.


- 6 Slide the sliding-plate lever to release the shoulder screw and slide the hard-drive carrier out of the 5.25-inch drive bay.



- 1 sliding-plate lever      2 optional fifth hard drive


**NOTE:** The optional fifth SATA hard drive can be installed in any of the 5.25-inch drive bays.


- 7 Press the blue tabs on each side of the hard-drive bracket toward each other and slide the drive up and out of the hard-drive carrier.
- 8 Set the drive and carrier aside in a secure location.
- 9 Ensure that all connectors are properly cabled and firmly seated.
- 10 If you are not installing another drive in the drive bay, install a drive panel insert (see "Replacing a Drive-Panel Insert" on page 249).
- 11 Reinstall the drive panel (see "Replacing the Drive Panel" on page 249).
- 12 Replace the computer cover (see "Replacing the Computer Cover" on page 145).


 **NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

13 Connect the computer and devices to electrical outlets, and turn them on.

### Installing a Fifth SATA Hard Drive (Optional)

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the **Product Information Guide**.


 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before removing the cover.


 **NOTICE:** In order to install a fifth SATA hard drive in one of the 5.25-inch drive bays, it must be installed in the provided hard-drive carrier.

1 If you are installing a new drive, unpack the drive and prepare it for installation.

Check the documentation for the drive to verify that it is configured for your computer.

2 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your **Product Information Guide** for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

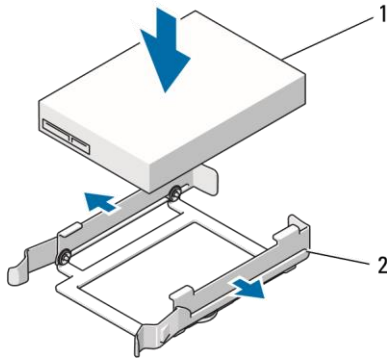
3 Remove the computer cover (see "Removing the Computer Cover" on page 141).

4 Remove the drive panel (see "Removing the Drive Panel" on page 246).

5 *If you are installing a new drive*, remove the drive-panel insert from a 5.25-inch drive bay (see "Removing a Drive-Panel Insert" on page 247).

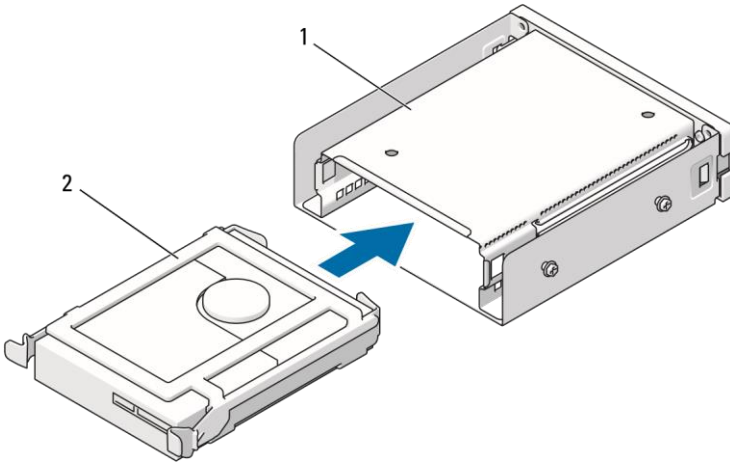
*If you already have a drive installed in the drive bay*, remove the optical or hard drive. See the appropriate removal instructions.

6 Place the SATA hard drive in the hard-drive bracket and press the drive down until it snaps securely into place.



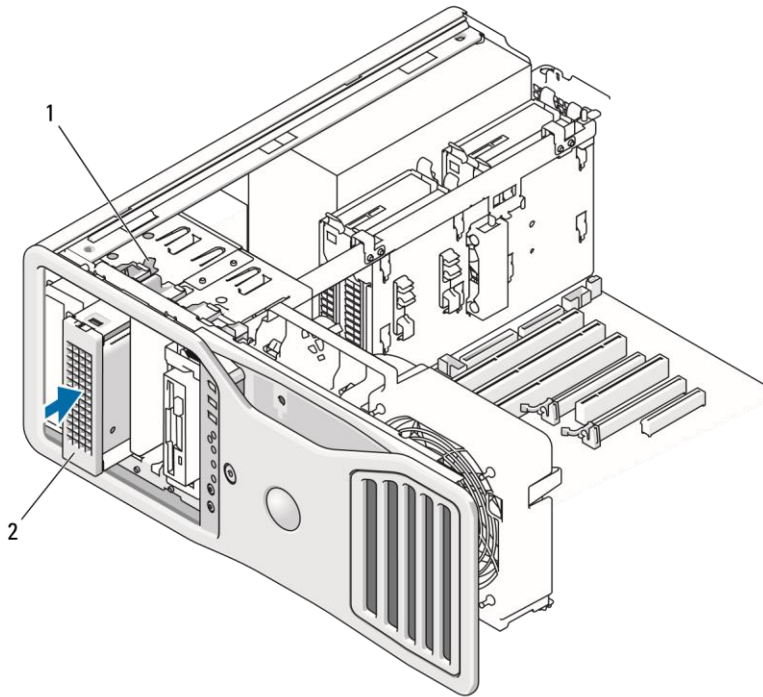
1 hard drive      2 hard-drive bracket

**7** Slide the hard drive in the hard-drive bracket into the hard-drive carrier.



1 hard-drive carrier      2 hard drive in hard-drive bracket

**8** Slide the hard-drive carrier into the 5.25-inch drive bay until it is securely seated.



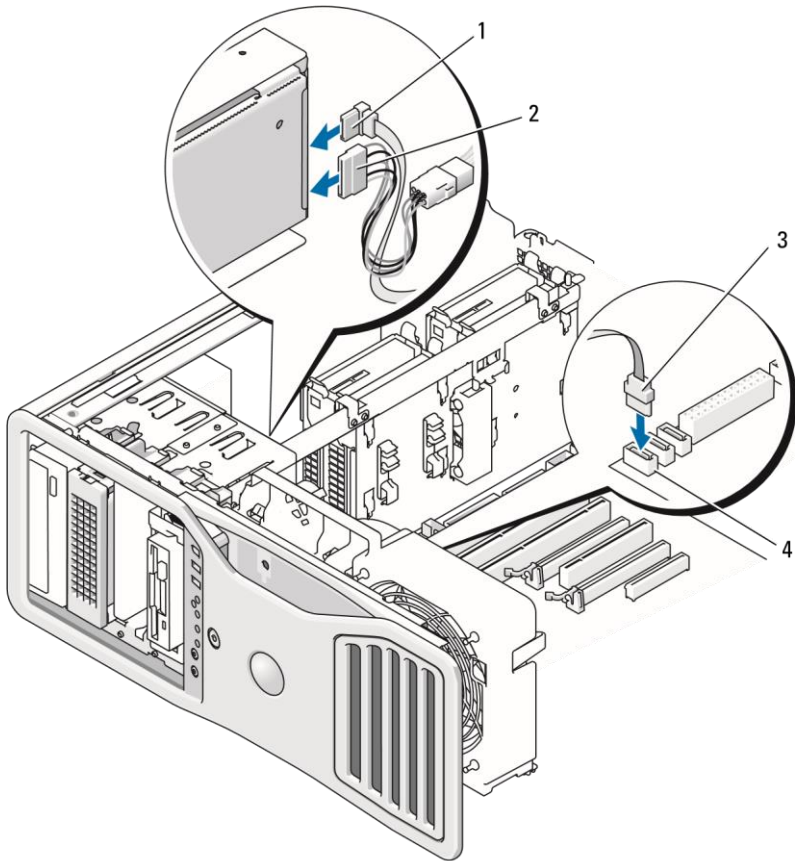
1 sliding-plate lever

2 hard-drive carrier with hard drive

**NOTE:** The optional fifth SATA hard drive can be installed in any of the 5.25-inch drive bays.

**9** Connect a power cable to the hard drive.

**10** Connect the data cable to the back of the drive and to the connector on the system board.



1 data cable

2 power cable

3 data cable

4 SATA2 connector on system board

**11** Ensure that all connectors are properly cabled and firmly seated.

**12** Reinstall the drive panel (see "Replacing the Drive Panel" on page 249).


**13** Replace the computer cover (see "Replacing the Computer Cover" on page 145).




**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

- 14 Connect the computer and devices to electrical outlets, and turn them on.  
See the documentation that came with the drive for instructions on installing any software required for drive operation.
- 15 If the drive you just installed is the primary drive, insert bootable disc into drive A.
- 16 Turn on the computer.
- 17 Enter system setup, and update the appropriate **Drive** option (see "System Setup" on page 75).
- 18 Exit system setup, and reboot the computer.
- 19 Partition and logically format your drive before you proceed to the next step.
- 20 See the documentation for your operating system for instructions.


## Drive Panels


 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions located in the **Product Information Guide**.

 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before removing the cover.

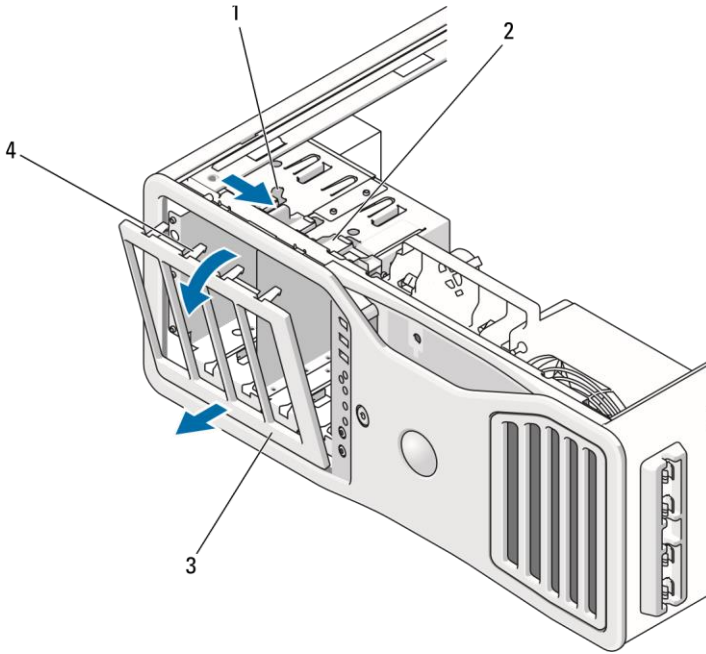
### Removing the Drive Panel

- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your **Product Information Guide** for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Grasp the sliding plate lever and push it towards the base of the computer until the drive panel snaps open.



- |                       |                    |
|-----------------------|--------------------|
| 1 sliding-plate lever | 2 sliding-plate    |
| 3 drive panel         | 4 drive-panel tabs |

- 4 Pivot the drive panel outward and lift it from its side hinges.
- 5 Set the drive panel aside in a secure location.

### Removing a Drive-Panel Insert

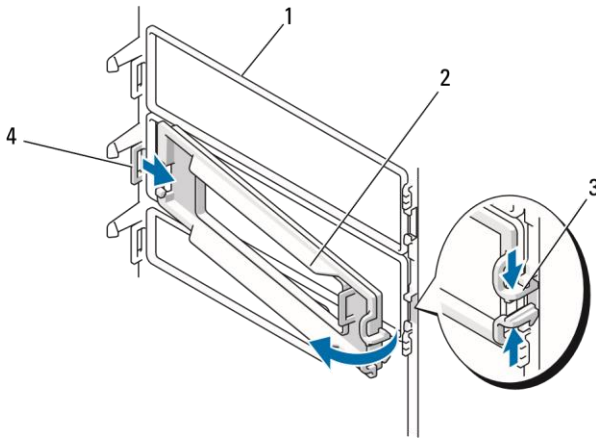
**NOTICE:** Drive-panel inserts may contain screws on the inside. You can attach the screws to new drives that do not have any screws.

- 1 Remove the drive panel (see "Removing the Drive Panel" on page 246).

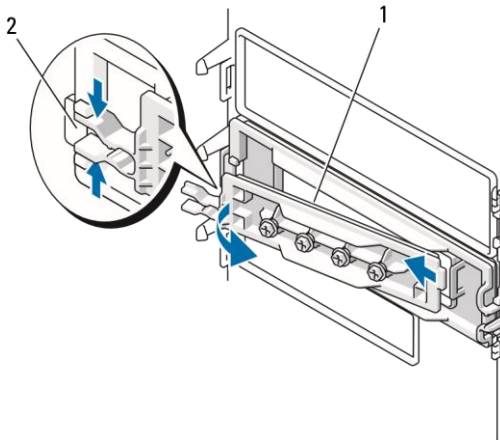
**NOTICE:** To avoid breaking the drive-panel insert tab, do not pull the insert more than approximately 1 cm (½ inch) away from the drive panel before sliding the tab out of the slot.

- 2 Pinch the drive-panel insert release tabs and rotate the insert just enough to free the release tabs.





- 1 drive panel
- 2 drive-panel insert
- 3 drive-panel insert release tabs (2)
- 4 drive-panel insert tab in tab slot

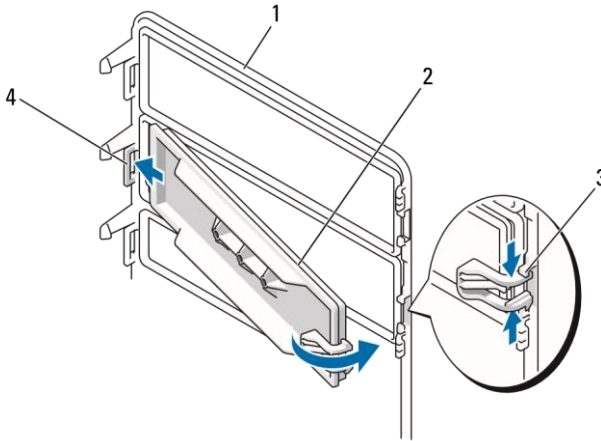


- 1 drive-panel insert pane
- 2 drive-panel insert release tabs (2)

**3** Slide the drive panel insert tab out from the tab slot **4** Set the drive-panel insert aside in a secure location.

## Replacing a Drive-Panel Insert

- 1 Slide the drive-panel insert tab into the drive-panel slot.



- |                                       |                                      |
|---------------------------------------|--------------------------------------|
| 1 drive panel                         | 2 drive-panel insert                 |
| 3 drive-panel insert release tabs (2) | 4 drive-panel insert tab in tab slot |

- 2 Pinch the drive-panel insert release tabs together and rotate the drivepanel insert into place.
- 3 Ensure that the drive-panel insert is correctly seated in the drive panel.

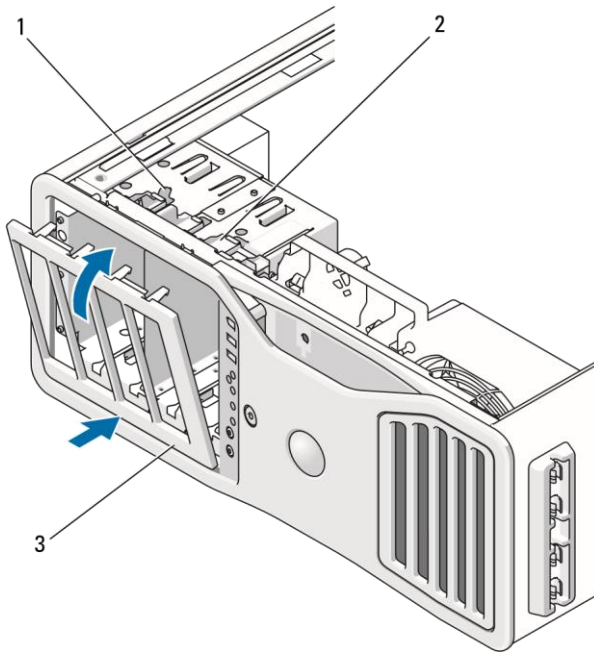
## Replacing the Drive Panel

- 1 Follow the procedures in "Before You Begin" on page 139.

**⚠ CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

**⚠ CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Align the drive panel tabs with the side-door hinges.



1 sliding-plate lever

2 sliding-plate


3 drive panel


- 3 Rotate the drive panel toward the computer until it snaps into place on the drive panel.
- 4 Replace the computer cover (see "Replacing the Computer Cover" on page 145).


See the documentation that came with the drive for instructions on installing any software required for drive operation.

## Floppy Drive

**⚠ CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.


 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.


 **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

 **NOTE:** A floppy drive or Media Card Reader must be installed in the 3.5-inch drive carrier in order to be installed in a drive bay.

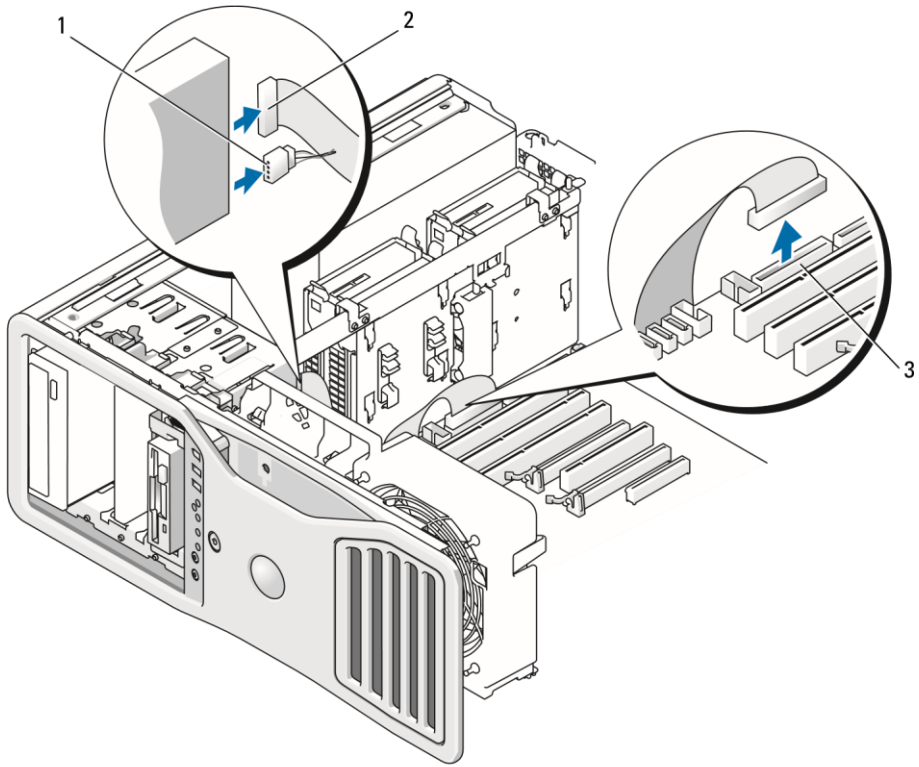
### Removing a Floppy Drive

- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

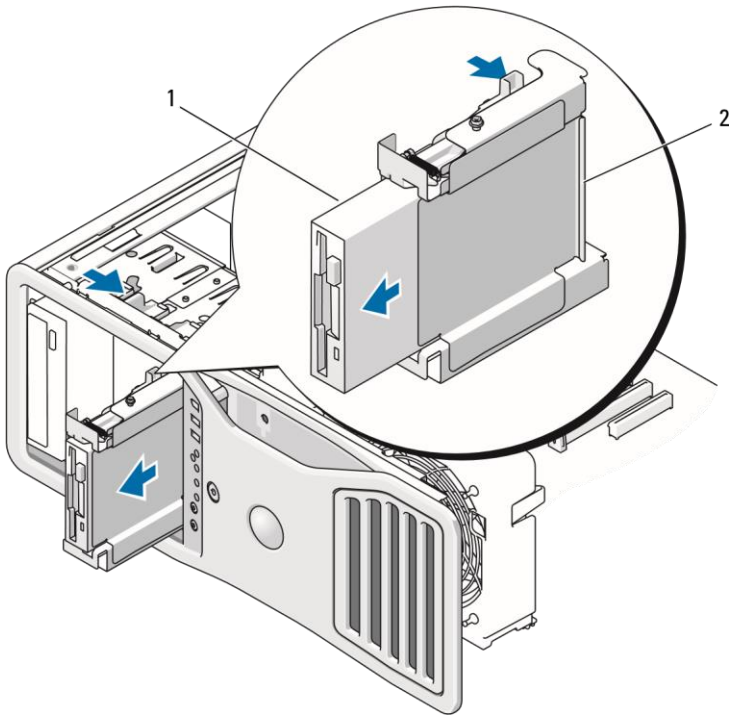
 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Remove the drive panel (see "Removing the Drive Panel" on page 246).
- 4 Disconnect the power and data cables from the back of the floppy drive.
- 5 Disconnect the other end of the drive cable from the system board connector labeled "DSKT." To locate system board connectors, see "System Board Components" on page 27.



- 1 power cable
- 2 data cable
- 3 floppy-drive connector (DSKT)

**6** Slide the sliding-plate lever to the right to release the shoulder screw and slide the drive carrier out of the drive bay.




1 floppy drive

2 floppy drive carrier


- 7** Press down the release lever on the side of the drive carrier and pull the drive out.
- 8** If you are not installing another drive in the drive bay:
  - a** Reinstall the empty drive carrier by sliding it back into the drive bay until it clicks into place.


If you later decide to install another floppy drive or a Media Card Reader in that drive bay, you can slide it into the drive carrier without removing the carrier from the drive bay.
  - b** Install a drive panel insert (see "Replacing a Drive-Panel Insert" on page 249).

- 9 If you are installing another drive in the drive bay, see the appropriate installation instructions.
  - 10 Reinstall the drive panel (see "Replacing the Drive Panel" on page 249).
  - 11 Replace the computer cover (see "Replacing the Computer Cover" on page 145).
-  **NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.
- 12 Connect the computer and devices to electrical outlets, and turn them on.

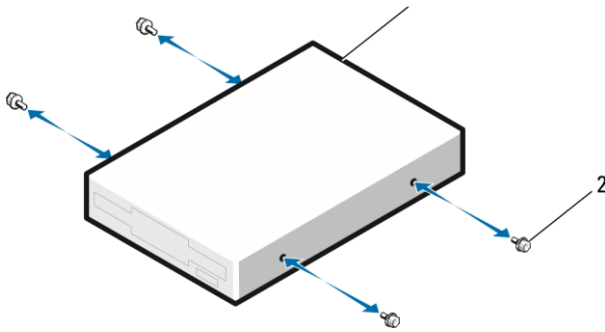
### Installing a Floppy Drive

- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Remove the drive panel (see "Removing the Drive Panel" on page 246).
- 4 If installed, remove the 3.5-inch drive-panel insert (see "Removing a DrivePanel Insert" on page 247).  
Ensure that the 3.5-inch drive panel plate is installed.
- 5 If another device is installed in the drive bay, remove that device (see the appropriate device removal instructions).
- 6 If no screws are attached to the drive, check the inside of the drive panel for shoulder screws. If screws are present, attach the screws to the new drive.

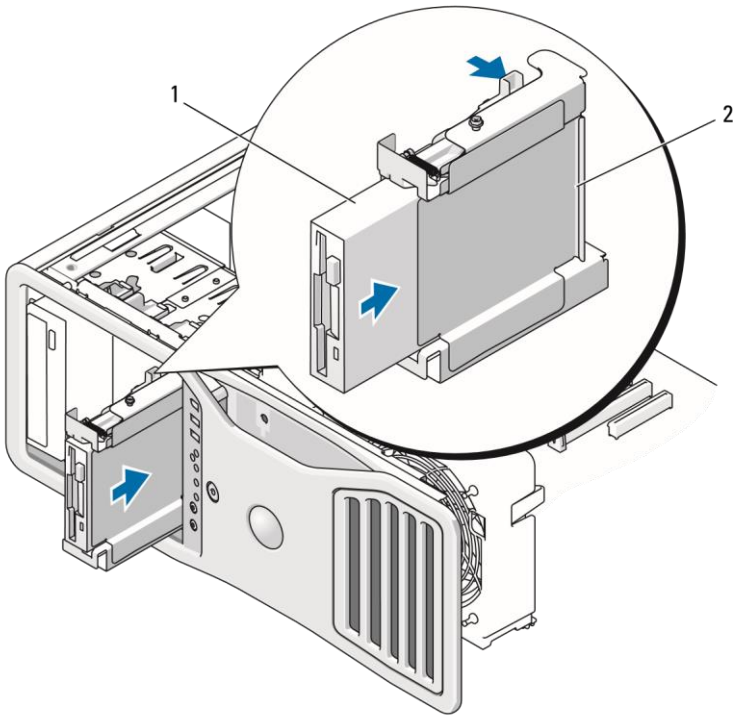


1 floppy drive

2 screws (4)

- 7 If an empty 3.5-inch drive carrier is installed in the drive bay, slide the floppy drive into the drive carrier until it clicks into place. Otherwise:
  - a Slide the floppy drive into the 3.5-inch drive carrier until it clicks into place.
  - b Then, while pressing down the release lever on the side of the drive carrier, slide the drive carrier into the drive bay until it clicks into place.

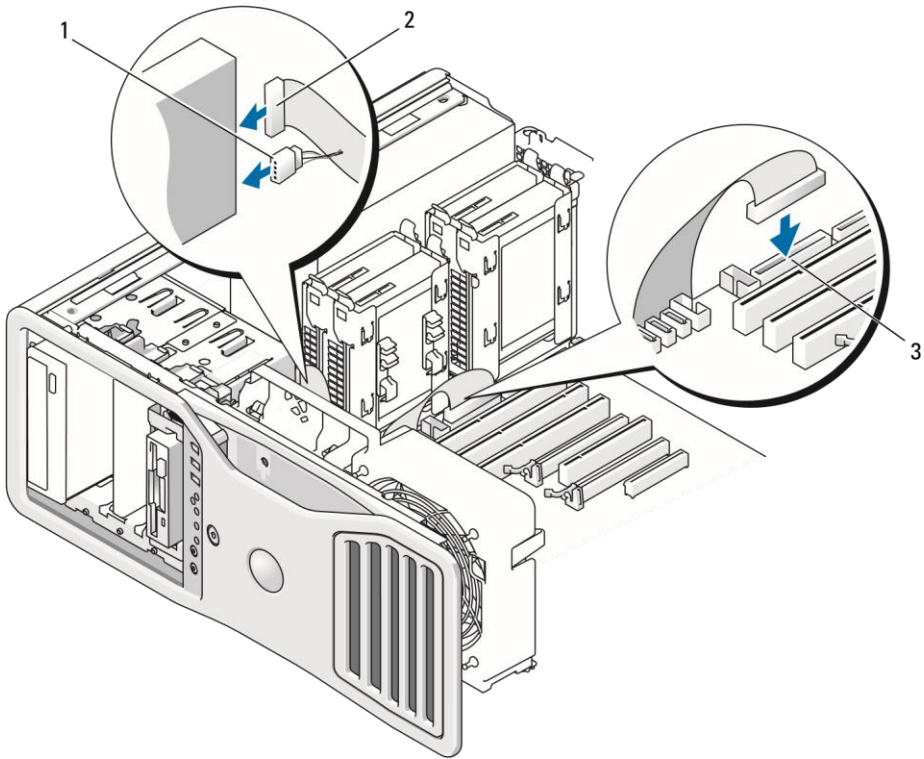




1 floppy drive

2 floppy drive carrier

- 8 Attach the power and data cables to the floppy drive.
- 9 Connect the other end of the data cable to the system board connector labeled "DSKT." To locate the system board connector, see "System Board Components" on page 27.



- 1 power cable
- 2 data cable
- 3 floppy-drive connector (DSKT)

**10** Check all cable connections and fold cables out of the way to avoid blocking airflow between the fan and cooling vents.

**11** Reinstall the drive panel (see "Replacing the Drive Panel" on page 249).

**12** Replace the computer cover (see "Replacing the Computer Cover" on page 145).




**NOTICE:** To connect a network cable, first plug the cable in to the network port or device and then plug it in to the computer.


**13** Connect your computer and devices to their electrical outlets, and turn them on.


See the documentation that came with the drive for instructions on installing any software required for drive operation.


- 14 Enter system setup and select the appropriate **Diskette Drive** option (see "System Setup" on page 75).
- 15 Verify that your computer works correctly by running the Dell Diagnostics (see "Dell Diagnostics" on page 123).

## Media Card Reader

 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the **Product Information Guide**.


 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.


 **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

 **NOTE:** A floppy drive or Media Card Reader must be installed in the 3.5-inch drive carrier in order to be installed in a drive bay.

## Removing a Media Card Reader

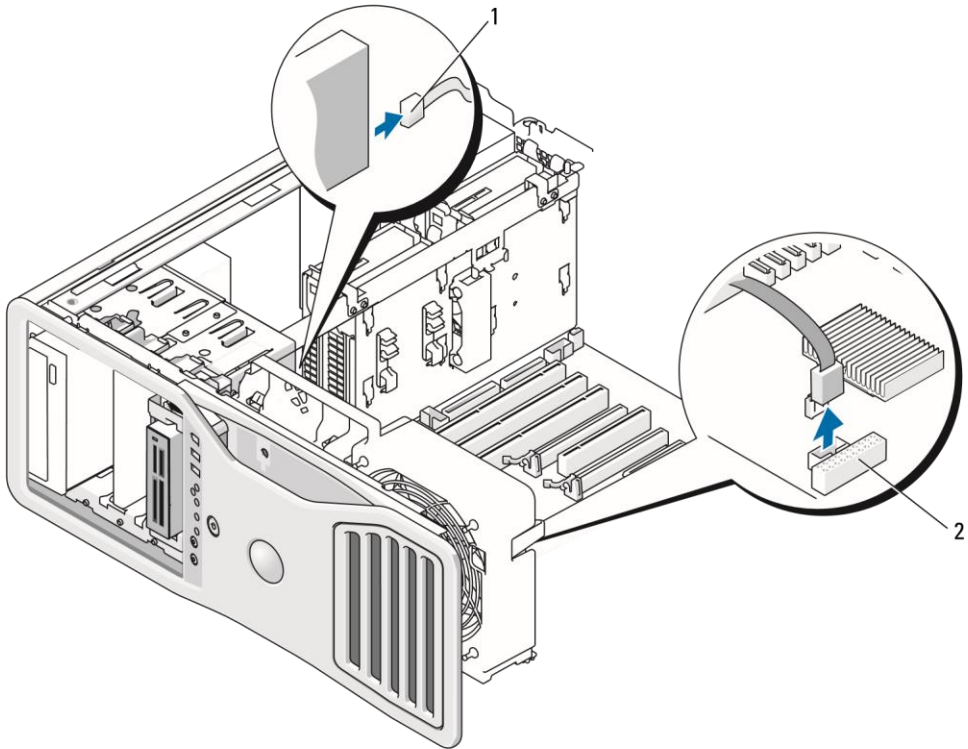
- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your **Product Information Guide** for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

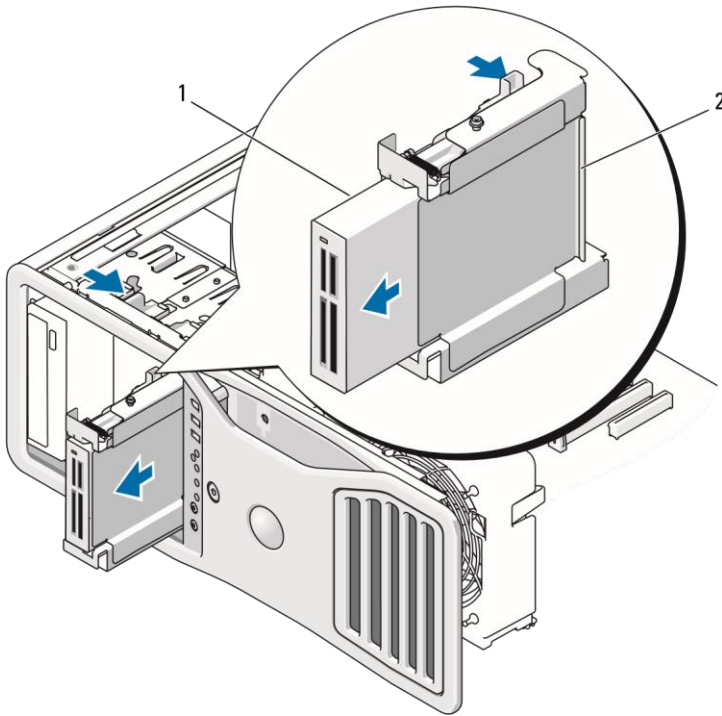
- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Remove the drive panel (see "Removing the Drive Panel" on page 246).
- 4 Disconnect the interface cable from the back of the Media Card Reader.

- 5 Disconnect the other end of the interface cable from the system board connector labeled "USB." To locate system board connectors, see "System Board Components" on page 27.



- 1 interface cable      2 Media Card Reader connector (USB)

- 6 Slide the sliding-plate lever to the right to release the shoulder screw and slide the drive carrier out of the drive bay.




1 Media Card Reader

2 floppy drive/Media Card Reader carrier

- 7 Press down the release lever on the side of the drive carrier and pull the Media Card Reader out.
- 8 If you are not installing another drive in the drive bay:
  - a Reinstall the empty drive carrier by sliding it back into the drive bay until it clicks into place.


If you later decide to install another floppy drive or a Media Card Reader in that drive bay, you can slide it into the drive carrier without removing the carrier from the drive bay.


- b Install a drive panel insert (see "Replacing a Drive-Panel Insert" on page 249).

- 9 If you are installing another drive in the drive bay, see the appropriate installation instructions.
- 10 Reinstall the drive panel (see "Replacing the Drive Panel" on page 249).
- 11 Replace the computer cover (see "Replacing the Computer Cover" on page 145).
-  **NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.
- 12 Connect the computer and devices to electrical outlets, and turn them on.

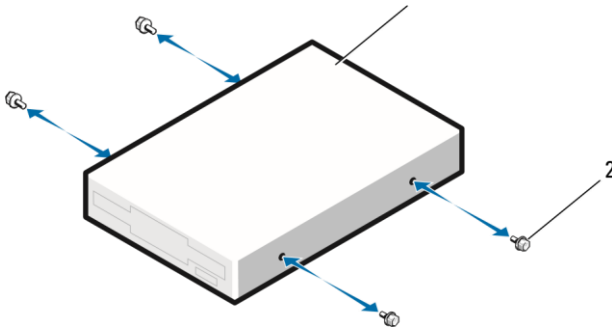
## Installing a Media Card Reader

- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Remove the drive panel (see "Removing the Drive Panel" on page 246).
- 4 If the 3.5-inch drive-panel insert is installed, remove it (see "Removing a Drive-Panel Insert" on page 247). Otherwise, ensure that the 3.5-inch drive panel plate is installed.
- 5 If another device is installed in the drive bay, remove that device (see the appropriate device removal instructions).
- 6 If no screws are attached to the Media Card Reader, check the inside of the drive panel for shoulder screws. Attach screws to the new card reader.

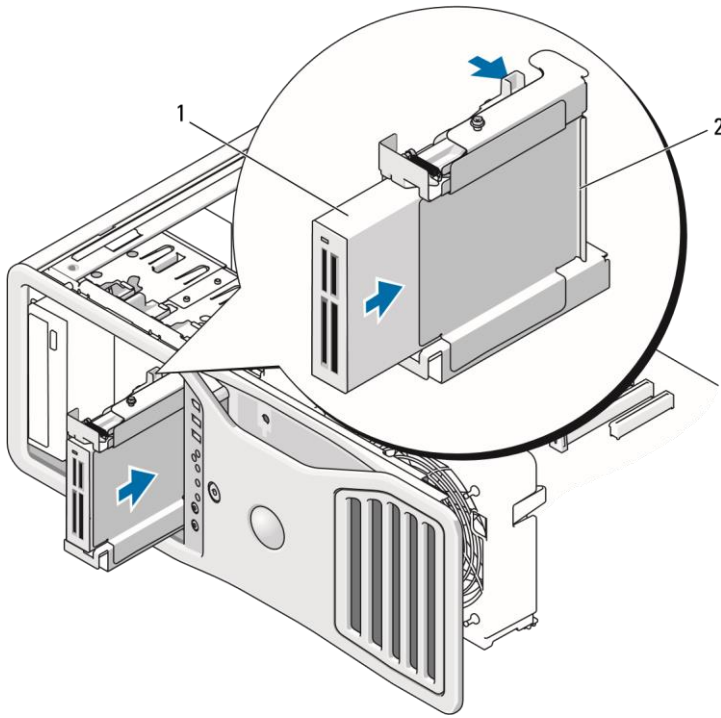


1 Media Card Reader 2 screws (4)

**7** If an empty 3.5-inch drive carrier is installed in the drive bay, slide the Media Card Reader into the drive carrier until it clicks into place.

Otherwise:

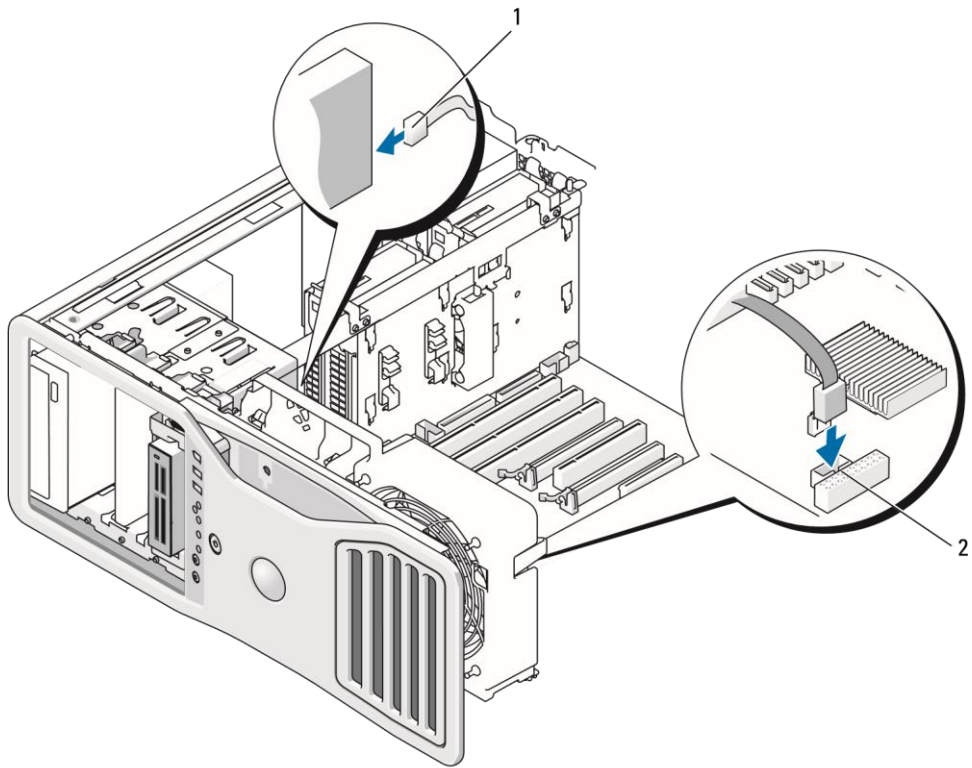
- a** Slide the Media Card Reader into the 3.5-inch drive carrier until it clicks into place.
- b** Then, while pressing down the release lever on the side of the drive carrier, slide the drive carrier into the drive bay until it clicks into place.



1 Media Card Reader    2 floppy drive/Media Card Reader carrier

- 8 Attach the interface cable to the Media Card Reader.
- 9 Connect the other end of the interface cable to the system board connector labeled "USB." To locate the system board connector, see "System Board Components" on page 27.





1 interface cable      2 Media Card Reader connector (USB)

**10** Check all cable connections and fold cables out of the way to avoid blocking airflow between the fan and cooling vents.

**11** Reinstall the drive panel (see "Replacing the Drive Panel" on page 249).


**12** Replace the computer cover (see "Replacing the Computer Cover" on page 145).


**ⓘ** **NOTICE:** To connect a network cable, first plug the cable in to the network port or device and then plug it in to the computer.


**13** Connect your computer and devices to their electrical outlets, and turn them on.  
See the documentation that came with the drive for instructions on installing any software required for drive operation.

- 14 Enter system setup and select the appropriate **USB for FlexBay** option (see "System Setup" on page 75).
- 15 Verify that your computer works correctly by running the Dell Diagnostics (see "Dell Diagnostics" on page 123).

## Optical Drive


 **CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.


 **CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.

 **NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.

### Removing an Optical Drive

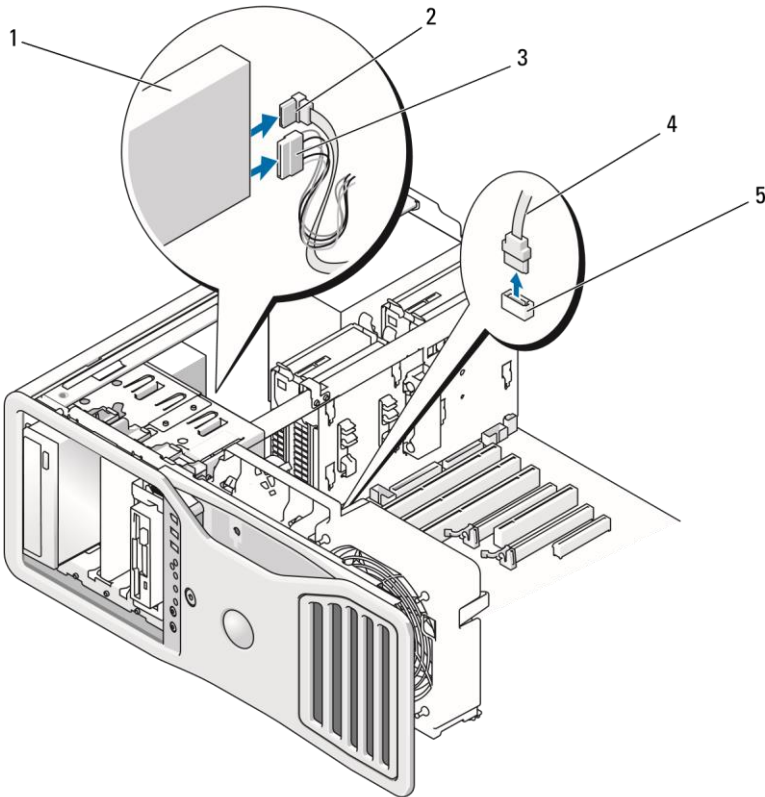
- 1 Follow the procedures in "Before You Begin" on page 139.

 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

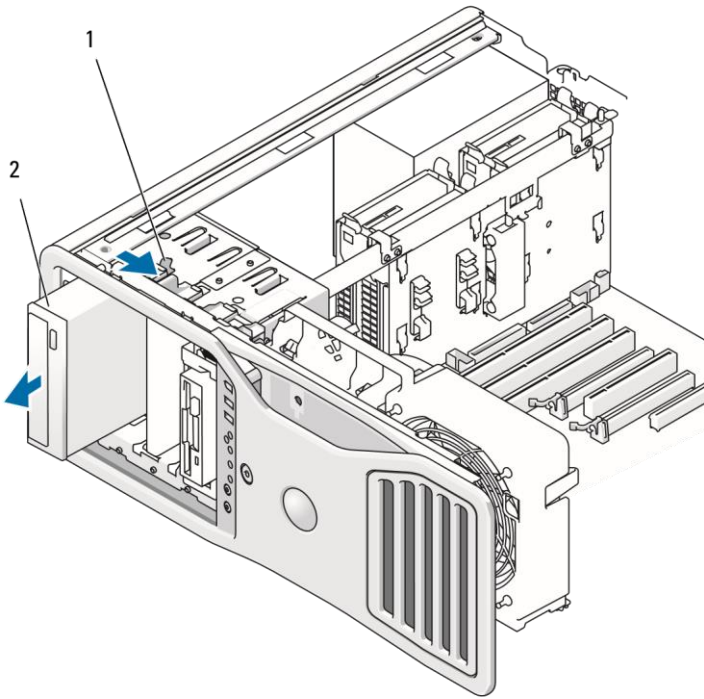
- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 3 Remove the drive panel (see "Removing the Drive Panel" on page 246).
- 4 Disconnect the power and data cables from the back of the optical drive.
- 5 If you are removing your only IDE optical drive and will not replace it at this time, disconnect the data cable from the system board and set it aside.

If you are removing a SATA optical drive and not replacing it, disconnect the SATA data cable from the system board.



- 1 optical drive
- 2 data cable
- 3 power cable
- 4 data cable
- 5 SATA connector on system board

6 Slide the sliding-plate lever to the right to release the shoulder screw and slide the drive out to remove it from the drive bay.



1 sliding-plate lever

2 optical drive

- 7 If you are not installing another drive in the optical drive bay, install a drive panel insert (see "Replacing a Drive-Panel Insert" on page 249).
- 8 If you are installing another drive in the optical drive bay, see the appropriate installation instructions in this section.
- 9 Reinstall the drive panel (see "Replacing the Drive Panel" on page 249).
- 10 Replace the computer cover (see "Replacing the Computer Cover" on page 145).





**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

- 11 Connect the computer and devices to electrical outlets, and turn them on.

## Installing an Optical Drive

- 1 Follow the procedures in "Before You Begin" on page 139.

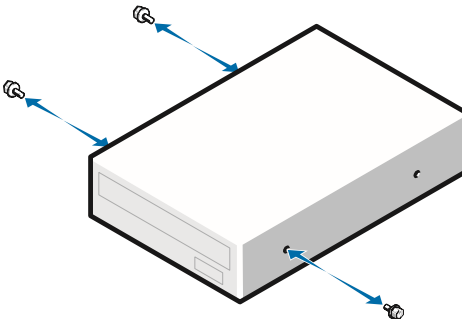
 **CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

 **CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

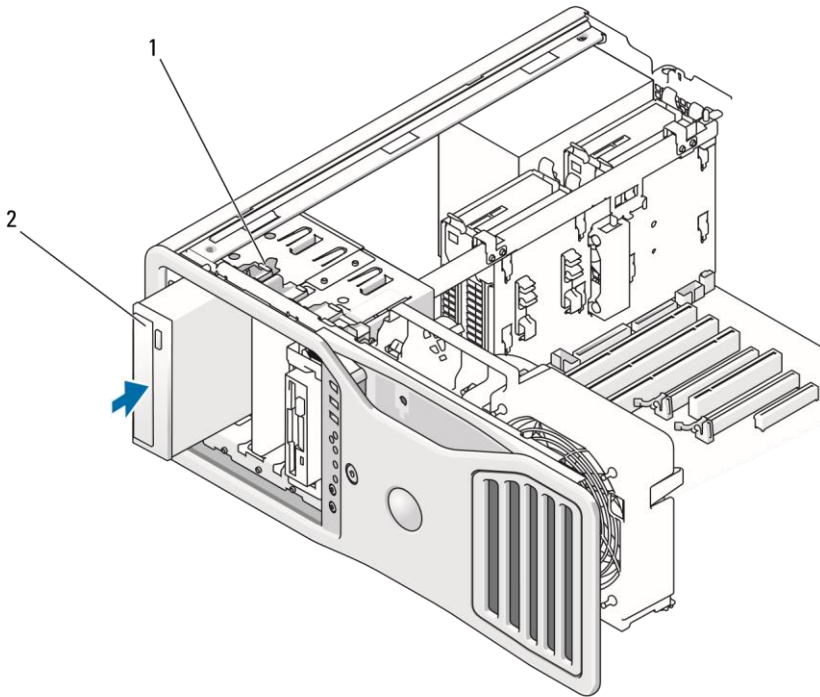
- 2 If you are installing a new drive, unpack the drive and prepare it for installation.

Check the documentation that accompanied the drive to verify that the drive is configured for your computer.

- 3 Remove the computer cover (see "Removing the Computer Cover" on page 141).
- 4 Remove the drive panel (see "Removing the Drive Panel" on page 246).
- 5 If another device is installed in the optical drive bay, remove that device (see the appropriate instructions in this section).
- 6 If the optical drive bay is unpopulated, remove the drive panel insert (see "Removing a Drive-Panel Insert" on page 247).
- 7 If no screws are attached to the drive, check the inside of the drive panel for screws, and attach screws to the new drive.



- 8 Gently slide the drive into place until you hear a click or feel the drive securely installed.



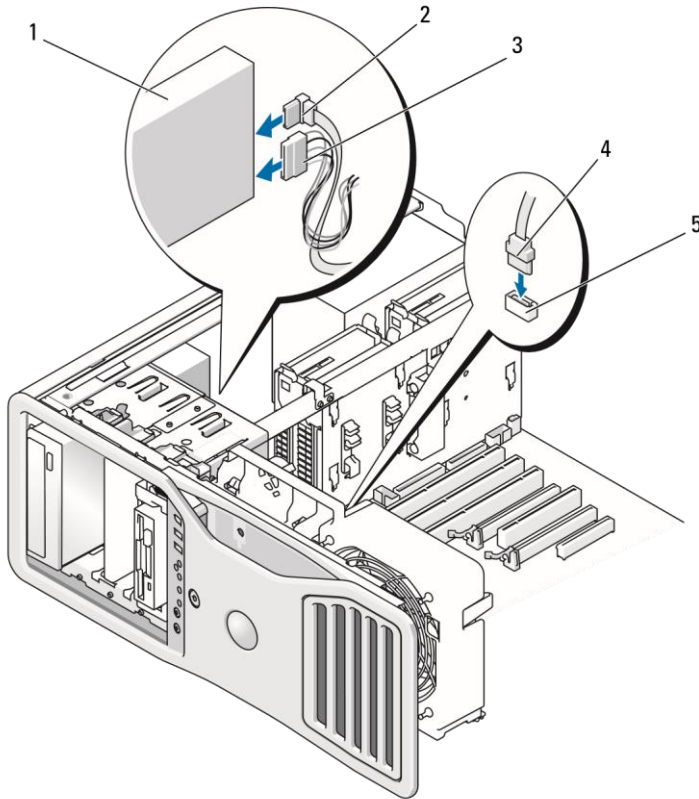
1 sliding-plate lever

2 optical drive

9 Attach the power and data cables to the optical drive.

**NOTICE:** Do not attach a SATA optical drive to an HDD connector on the system board or it will not function. Attach SATA optical drives to the connectors labeled

10 If you are installing a SATA drive, connect the other end of the data cable to a SATA connector on the system board.



- |   |                                |   |            |
|---|--------------------------------|---|------------|
| 1 | optical drive                  | 2 | data cable |
| 3 | power cable                    | 4 | data cable |
| 5 | SATA connector on system board |   |            |

- 11 Check all cable connections and fold cables out of the way to avoid blocking airflow between the fan and cooling vents.
- 12 Reinstall the drive panel (see "Replacing the Drive Panel" on page 249).
- 13 Replace the computer cover (see "Replacing the Computer Cover" on page 145).



**NOTICE:** To connect a network cable, first plug the cable in to the network port or device and then plug it in to the computer.

- 14 Connect your computer and devices to their electrical outlets, and turn them on.  
See the documentation that came with the drive for instructions on installing any software required for drive operation.
- 15 Enter system setup (see "System Setup" on page 75) and select the appropriate Drive option.
- 16 Verify that your computer works correctly by running the Dell Diagnostics (see "Dell Diagnostics" on page 123).

## System Board



**CAUTION:** Before you begin any of the procedures in this section, follow the safety instructions in the Product Information Guide.



**CAUTION:** To guard against electrical shock, always unplug your computer from the electrical outlet before opening the cover.



**NOTICE:** To prevent static damage to components inside your computer, discharge static electricity from your body before you touch any of your computer's electronic components. You can do so by touching an unpainted metal surface on the computer.



**NOTICE:** The system board and metal tray are connected and are removed as one piece.

### Removing the System Board

- 1 Follow the procedures in "Before You Begin" on page 139.



**CAUTION:** Your computer is heavy (it has an approximate minimum weight of 55 lbs) and can be difficult to maneuver. Seek assistance before attempting to lift, move, or tilt it; this computer requires a two-man lift. Always lift correctly to avoid injury; avoid bending over while lifting. See your Product Information Guide for other important safety information.

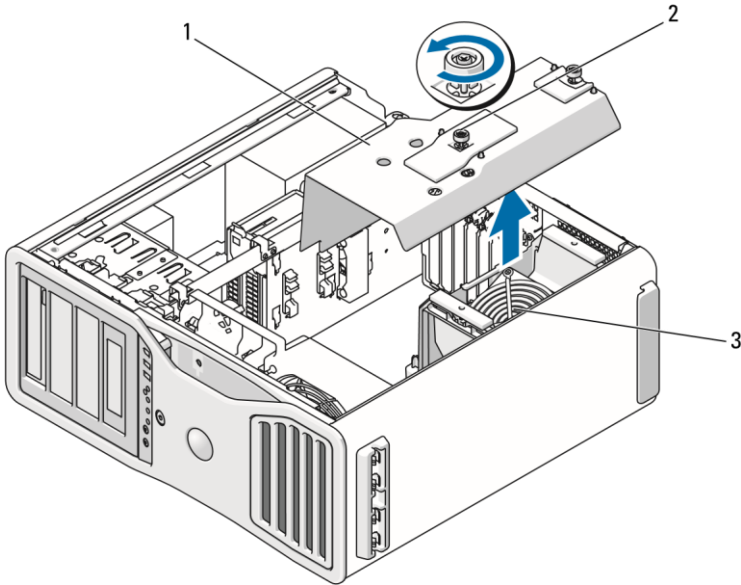


**CAUTION:** The computer stand should be installed at all times to ensure maximum system stability. Failure to install the stand could result in the computer tipping over, potentially resulting in bodily injury or damage to the computer.

- 2 Remove the computer cover (see "Removing the Computer Cover" on page 141).



- 3 Remove the memory shroud by loosening its two thumbscrews and lifting it from the computer.



1 memory shroud

2 thumbscrews (2)

- 3 memory fan (only present on systems without memory riser cards)

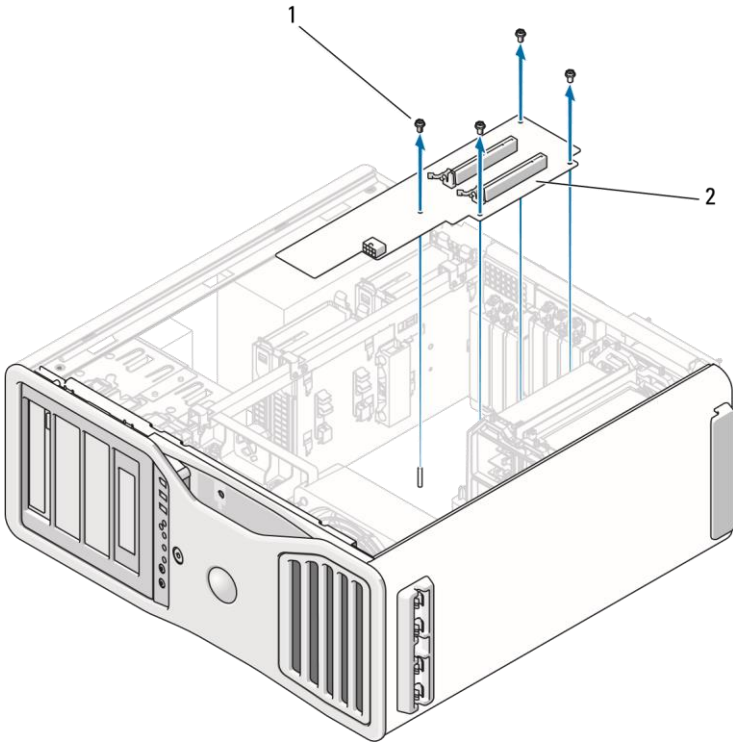
- 4 Lift to remove the memory risers, if installed.

- 5 If a graphics riser card is installed, remove it:

- a Remove its four screws. b Disconnect its power cable.

- c Move it slightly up and to the right at an angle to free it from the card fan and the memory-riser support structure.

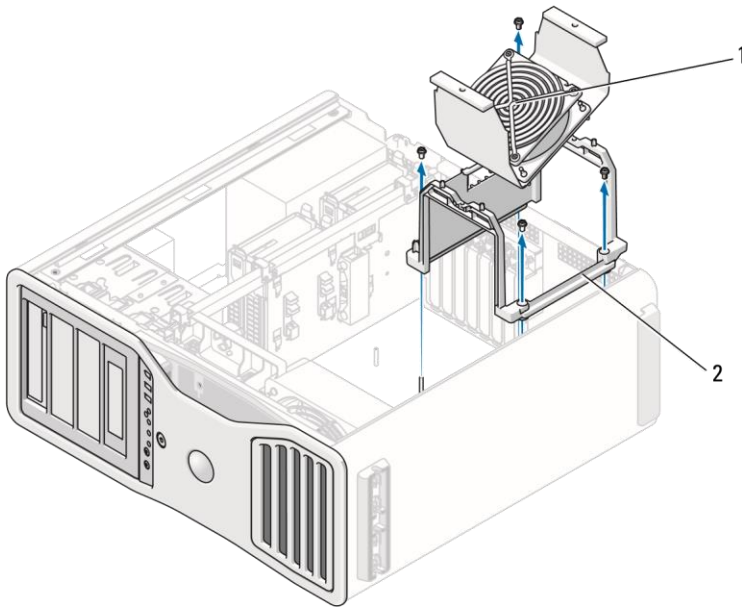
- d Set the riser aside.



1 screws (4)

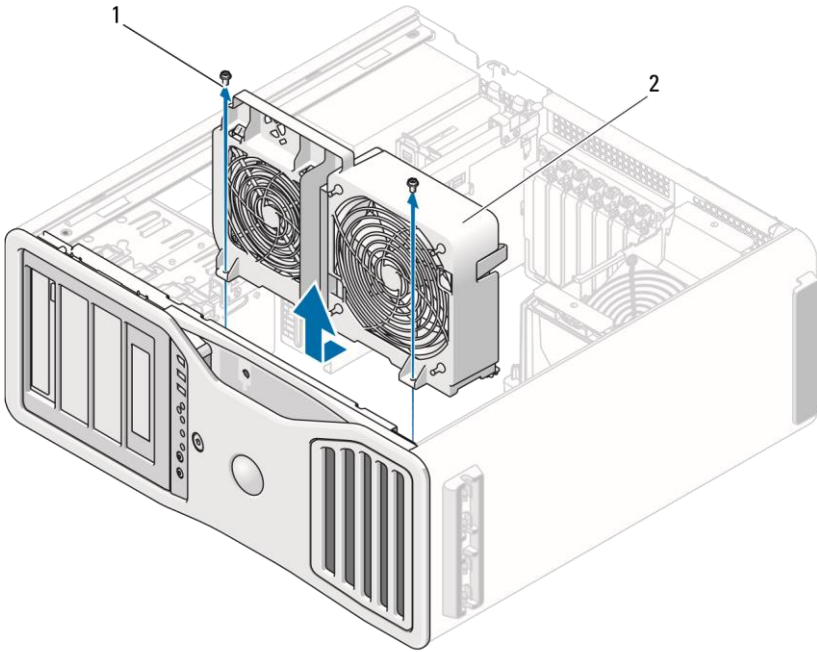
2 graphics riser card

- 6 If you do not have memory risers installed, lift to remove the memory fan from the fan support structure.
- 7 Remove the fan support structure or memory-riser support structure:
  - a Remove the four screws that attach it to the system board.
  - b Lift it from the computer.



1 memory fan (only present on computers without memory riser cards)      2 fan support structure

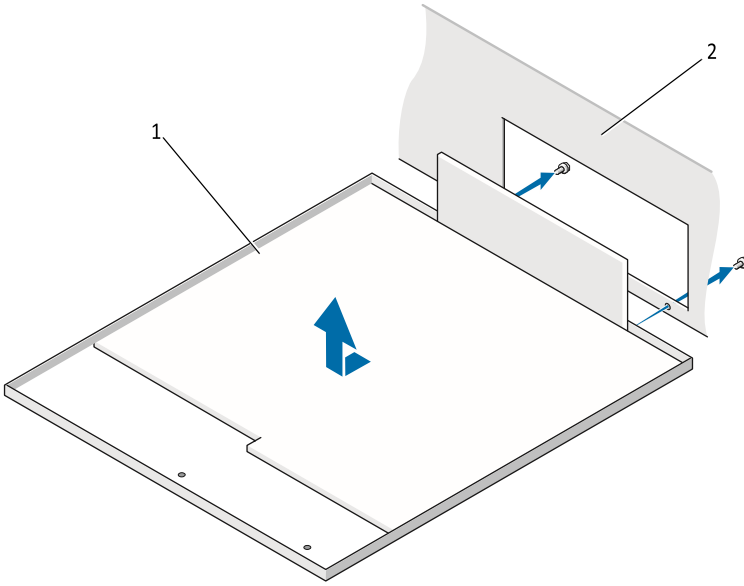
- 8 Disconnect the speaker cable from the system board.
- 9 Disconnect the front fan and the card fan from the system board.
- 10 Unscrew the two screws that hold the processor and card fan case in place and lift it away from the computer. These screws help to secure the system board in place.



1 screws (2)

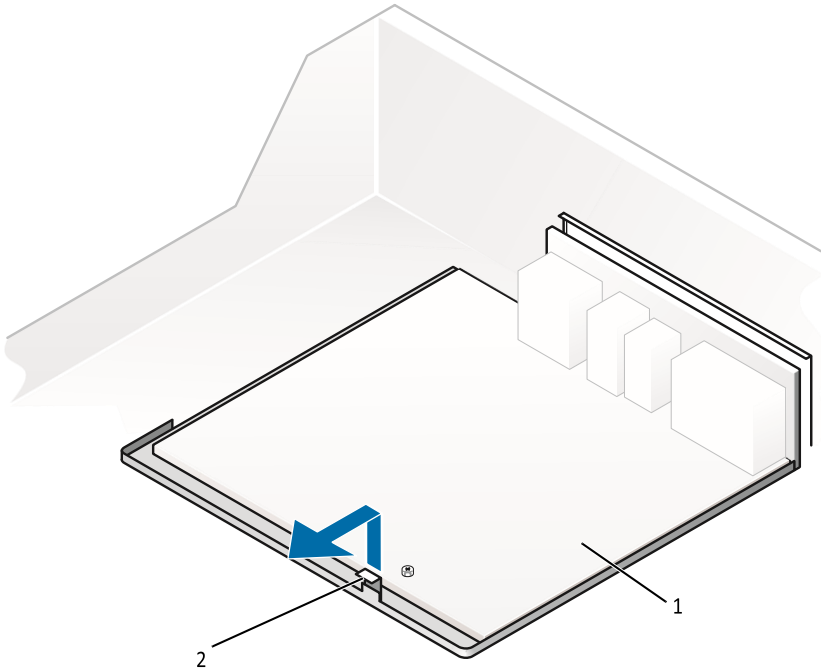
2 processor and card fan case

- 11 Remove any components that restrict access to the system board.
- 12 Disconnect all cables from the system board.
- 13 Before you remove the existing system board assembly, visually compare the replacement system board to the existing system board to ensure that you have the correct part.
- 14 Remove the two screws that attach the system board assembly to the back of the computer chassis.



1 system board assembly

2 back of computer



1 tab

2 system board assembly

- 15 Slide the system board assembly toward the front of the computer chassis to release the tabs on the computer chassis from the slots on the system board pan.
- 16 Lift the system board assembly from the computer.
- 17 Place the system board assembly that you just removed next to the replacement system board.

## Replacing the System Board

- 1 Transfer components from the existing system board to the replacement system board:
  - a Remove the memory modules or the memory module riser cards and install them on the replacement board. See "Memory" on page 172 for more information.



**CAUTION:** The processor package and heat-sink assembly can get hot. To avoid burns, ensure that the package and assembly have had sufficient time to cool before you touch them.

b Remove any installed heat-sink assemblies and processors from the existing system board and transfer them to the replacement system board. See "Removing the Processor" on page 150 for more information.

2 Set the jumpers on the replacement system board so that they are identical to the ones on the existing board (see "System Board Components" on page 27.)



**NOTE:** Some components and connectors on the replacement system board may be in different locations than the corresponding connectors on the existing system board.

3 Orient the replacement board by aligning the slots on the bottom of the system board pan with the tabs on the chassis, and slide the system board into place.

4 Screw the system board assembly into place.

5 Replace any components and cables that you removed from the system board.

6 Reconnect all cables to their connectors at the back of the computer.

7 Replace the computer cover (see "Removing the Computer Cover" on page 141).




**NOTICE:** To connect a network cable, first plug the cable into the network port or device and then plug it into the computer.

8 Connect your computer and devices to electrical outlets, and turn them on.

# 13

## Getting Help

### Obtaining Assistance

 **CAUTION:** If you need to remove the computer cover, first disconnect the computer power and modem cables from all electrical outlets.

If you experience a problem with your computer, you can complete the following steps to diagnose and troubleshoot the problem:

- 1 See "Troubleshooting" on page 93 for information and procedures that pertain to the problem your computer is experiencing.
- 2 See "Dell Diagnostics" on page 123 for procedures on how to run Dell Diagnostics.
- 3 Fill out the "Diagnostics Checklist" on page 286.
- 4 Use Dell's extensive suite of online services available at Dell Support (**support.dell.com**) for help with installation and troubleshooting procedures. See "Online Services" on page 282 for a more extensive list of Dell Support online.
- 5 If the preceding steps have not resolved the problem, see "Contacting Dell" on page 287.



**NOTE:** Call Dell Support from a telephone near or at the computer so that the support staff can assist you with any necessary procedures.



**NOTE:** Dell's Express Service Code system may not be available in all countries.

When prompted by Dell's automated telephone system, enter your Express Service Code to route the call directly to the proper support personnel. If you do not have an Express Service Code, open the **Dell Accessories** folder, double-click the **Express Service Code** icon, and follow the directions.



For instructions on using the Dell Support, see "Technical Support and Customer Service" on page 282.



**NOTE:** Some of the following services are not always available in all locations outside the continental U.S. Call your local Dell representative for information on availability.

## Technical Support and Customer Service

Dell's support service is available to answer your questions about Dell™ hardware. Our support staff uses computer-based diagnostics to provide fast, accurate answers.

To contact Dell's support service, see "Before You Call" on page 284, and then see the contact information for your region or go to **support.dell.com**.

## Online Services

You can learn about Dell products and services on the following websites:

**www.dell.com**

**www.dell.com/ap** (Asian/Pacific countries only) **www.dell.com/jp** (Japan only)

**www.euro.dell.com** (Europe only)

**www.dell.com/la** (Latin American and Caribbean countries)

**www.dell.ca** (Canada only)

You can access Dell Support through the following websites and e-mail addresses:

- Dell Support websites **support.dell.com**  
**support.jp.dell.com** (Japan only)  
**support.euro.dell.com** (Europe only)
- Dell Support e-mail addresses  
mobile\_support@us.dell.com  
support@us.dell.com  
la-techsupport@dell.com (Latin America and Caribbean countries only)  
apsupport@dell.com (Asian/Pacific countries only)

- Dell Marketing and Sales e-mail addresses  
apmarketing@dell.com (Asian/Pacific countries only)  
sales\_canada@dell.com (Canada only)

- Anonymous file transfer protocol (FTP)  
**ftp.dell.com**

Log in as user: `anonymous`, and use your e-mail address as your password.

## AutoTech Service

Dell's automated support service—AutoTech—provides recorded answers to the questions most frequently asked by Dell customers about their portable and desktop computers.

When you call AutoTech, use your touch-tone telephone to select the subjects that correspond to your questions. For the telephone number to call for your region, see "Contacting Dell" on page 287.

## Automated Order-Status Service

To check on the status of any Dell products that you have ordered, you can go to **support.dell.com**, or you can call the automated order-status service. A recording prompts you for the information needed to locate and report on your order. For the telephone number to call for your region, see "Contacting Dell" on page 287.

## Problems With Your Order

If you have a problem with your order, such as missing parts, wrong parts, or incorrect billing, contact Dell for customer assistance. Have your invoice or packing slip handy when you call. For the telephone number to call for your region, see "Contacting Dell" on page 287.

## Product Information

If you need information about additional products available from Dell, or if you would like to place an order, visit the Dell website at **www.dell.com**. For

the telephone number to call for your region or to speak to a sales specialist, see "Contacting Dell" on page 287.

## Returning Items for Warranty Repair or Credit

Prepare all items being returned, whether for repair or credit, as follows:

- 1 Call Dell to obtain a Return Material Authorization Number, and write it clearly and prominently on the outside of the box.  
For the telephone number to call for your region, see "Contacting Dell" on page 287.
- 2 Include a copy of the invoice and a letter describing the reason for the return.
- 3 Include a copy of the Diagnostics Checklist (see "Diagnostics Checklist" on page 286), indicating the tests that you have run and any error messages reported by the Dell Diagnostics (see "Dell Diagnostics" on page 123).
- 4 Include any accessories that belong with the item(s) being returned (power cables, software floppy disks, guides, and so on) if the return is for credit.
- 5 Pack the equipment to be returned in the original (or equivalent) packing materials.

You are responsible for paying shipping expenses. You are also responsible for insuring any product returned, and you assume the risk of loss during shipment to Dell. Collect On Delivery (C.O.D.) packages are not accepted.

Returns that are missing any of the preceding requirements will be refused at Dell's receiving dock and returned to you.

## Before You Call



**NOTE:** Have your Express Service Code ready when you call. The code helps Dell's automated-support telephone system direct your call more efficiently. You may also be asked for your Service Tag (located on the back or bottom of your computer).

Remember to fill out the Diagnostics Checklist (see "Diagnostics Checklist" on page 286). If possible, turn on your computer before you call Dell for assistance and call from a telephone at or near the computer. You may be asked to type some commands at the keyboard, relay detailed information during operations, or try other troubleshooting steps possible only at the computer itself. Ensure that the computer documentation is available.



**CAUTION:** Before working inside your computer, follow the safety instructions in your Product Information Guide.

**Diagnostics Checklist** Name:

Date:

Address:

Phone number:

Service Tag (bar code on the back or bottom of the computer):

Express Service Code:

Return Material Authorization Number (if provided by Dell support technician):

Operating system and version:

Devices:

Expansion cards:

Are you connected to a network? Yes No Network,

version, and network adapter:

Programs and versions:

See your operating system documentation to determine the contents of the system's start-up files. If the computer is connected to a printer, print each file. Otherwise, record the contents of each file before calling Dell.

Error message, beep code, or diagnostic code:

Description of problem and troubleshooting procedures you performed:

## **Contacting Dell**

For customers in the United States, call 800.WWW.DELL (800.999.3355).



**NOTE:** If you do not have an active Internet connection, you can find contact information on your purchase invoice, packing slip, bill, or Dell product catalog.

Dell provides several online and telephone-based support and service options. Availability varies by country and product, and some services may not be available in your area. To contact Dell for sales, technical support, or customer service issues:

- 1 Visit **support.dell.com**.
- 2 Verify your country or region in the **Choose A Country/Region** drop-down menu at the bottom of the page.
- 3 Click **Contact Us** on the left side of the page.
- 4 Select the appropriate service or support link based on your need.
- 5 Choose the method of contacting Dell that is convenient for you.

# 14 Appendix

## FCC Notice (U.S. Only)

### FCC Class B

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1 This device may not cause harmful interference.
- 2 This device must accept any interference received, including interference that may cause undesired operation.



**NOTICE:** The FCC regulations provide that changes or modifications not expressly approved by Dell Inc. could void your authority to operate this equipment.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference with radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Relocate the system with respect to the receiver.
- Move the system away from the receiver.




- Plug the system into a different outlet so that the system and the receiver are on different branch circuits.

If necessary, consult a representative of Dell Inc. or an experienced radio/television technician for additional suggestions.

#### Appendix

The following information is provided on the device or devices covered in this document in compliance with the FCC regulations:

- Product name: Dell™ Precision™ T7400
- Model number: DCDO
- Company name:  
Dell Inc.  
Worldwide Regulatory Compliance & Environmental Affairs  
One Dell Way  
Round Rock, TX 78682 USA  
512-338-4400

 **NOTE:** For further regulatory information, see your *Product Information Guide*.

## Appendix

# Glossary

Terms in this Glossary are provided for informational purposes only and may or may not describe features included with your particular computer.

## A

**AC** — alternating current — The form of electricity that powers your computer when you plug the AC adapter power cable in to an electrical outlet.

**ACPI** — advanced configuration and power interface — A power management specification that enables Microsoft® Windows® operating systems to put a computer in standby or hibernate mode to conserve the amount of electrical power allocated to each device attached to the computer.

**AGP** — accelerated graphics port — A dedicated graphics port that allows system memory to be used for video-related tasks. AGP delivers a smooth, true-color video image because of the faster interface between the video circuitry and the computer memory.

**AHCI** — Advanced Host Controller Interface — An interface for a SATA hard drive Host Controller which allows the storage driver to enable technologies such as Native Command Queuing (NCQ) and hot plug.

**ALS** — ambient light sensor — A feature that helps to control display brightness.

**antivirus software** — A program designed to identify, quarantine, and/or delete viruses from your computer.

**ASF** — alert standards format — A standard to define a mechanism for reporting hardware and software alerts to a management console. ASF is designed to be platform- and operating system-independent.

## B

**battery life span** — The length of time (years) during which a portable computer battery is able to be depleted and recharged.

**battery operating time** — The length of time (minutes or hours) that a portable computer battery powers the computer.

**BIOS** — basic input/output system — A program (or utility) that serves as an interface between the computer hardware and the operating system. Unless you understand what effect these settings have on the computer, do not change them. Also referred to as *system setup*. **bit** — The smallest unit of data interpreted by your computer.

**Blu-ray Disc™ (BD)**— An optical storage technology offering storage capacity of up to 50 GB, full 1080p video resolution (HDTV required), and as many as 7.1 channels of native, uncompressed surround sound.

**Bluetooth® wireless technology** — A wireless technology standard for short-range (9 m [29 feet]) networking devices that allows for enabled devices to automatically recognize each other.

**boot sequence** — Specifies the order of the devices from which the computer attempts to boot.

**bootable media** — A CD, DVD, or floppy disk that you can use to start your computer. In case your hard drive is damaged or your computer has a virus, ensure that you always have a bootable CD, DVD, or floppy disk available. Your *Drivers and Utilities* media is an example of bootable media.

**bps** — bits per second — The standard unit for measuring data transmission speed.

**BTU** — British thermal unit — A measurement of heat output.

**bus** — A communication pathway between the components in your computer.

**bus speed** — The speed, given in MHz, that indicates how fast a bus can transfer information. **byte** — The basic data unit used by your computer. A byte is usually equal to 8 bits.

## C

**C** — Celsius — A temperature measurement scale where 0° is the freezing point and 100° is the boiling point of water.

**cache** — A special high-speed storage mechanism which can be either a reserved section of main memory or an independent high-speed storage device. The cache enhances the efficiency of many processor operations.

**L1 cache** — Primary cache stored inside the processor.

**L2 cache** — Secondary cache which can either be external to the processor or incorporated into the processor architecture.

**carnet** — An international customs document that facilitates temporary imports into foreign countries. Also known as a *merchandise passport*.

**CD-R** — CD recordable — A recordable version of a CD. Data can be recorded only once onto a CD-R. Once recorded, the data cannot be erased or written over.

**CD-RW** — CD rewritable — A rewritable version of a CD. Data can be written to a CD-RW disc, and then erased and written over (rewritten).

**CD-RW drive** — A drive that can read CDs and write to CD-RW (rewritable CDs) and CD-R (recordable CDs) discs. You can write to CD-RW discs multiple times, but you can write to CD-R discs only once.

**CD-RW/DVD drive** — A drive, sometimes referred to as a combo drive, that can read CDs and DVDs and write to CD-RW (rewritable CDs) and CD-R (recordable CDs) discs. You can write to CD-RW discs multiple times, but you can write to CD-R discs only once.

**clock speed** — The speed, given in MHz, that indicates how fast computer components that are connected to the system bus operate.

**CMOS** — A type of electronic circuit. Computers use a small amount of battery-powered CMOS memory to hold date, time, and system setup options.

**COA** — Certificate of Authenticity — The Windows alpha-numeric code located on a sticker on your computer. Also referred to as the *Product Key* or *Product ID*.

**Control Panel** — A Windows utility that allows you to modify operating system and hardware settings, such as display settings.

**controller** — A chip that controls the transfer of data between the processor and memory or between the processor and devices.

**CRIMM** — continuity rambus in-line memory module — A special module that has no memory chips and is used to fill unused RIMM slots.

**cursor** — The marker on a display or screen that shows where the next keyboard, touch pad, or mouse action will occur. It often is a blinking solid line, an underline character, or a small arrow.

## D

**DDR SDRAM** — double-data-rate SDRAM — A type of SDRAM that doubles the data burst cycle, improving system performance.

**DDR2 SDRAM** — double-data-rate 2 SDRAM — A type of DDR SDRAM that uses a 4-bit prefetch and other architectural changes to boost memory speed to over 400 MHz.

**device** — Hardware such as a disk drive, printer, or keyboard that is installed in or connected to your computer. **device driver** — See *driver*.

**DIMM** — dual in-line memory module — A circuit board with memory chips that connects to a memory module on the system board.

**DIN connector** — A round, six-pin connector that conforms to DIN (Deutsche Industrie-Norm) standards; it is typically used to connect PS/2 keyboard or mouse cable connectors.

**disk striping** — A technique for spreading data over multiple disk drives. Disk striping can speed up operations that retrieve data from disk storage. Computers that use disk striping generally allow the user to select the data unit size or stripe width.

**DMA** — direct memory access — A channel that allows certain types of data transfer between RAM and a device to bypass the processor.

**docking device** — provides port replication, cable management, and security features to adapt your notebook to a desktop workspace.

**DMTF** — Distributed Management Task Force — A consortium of hardware and software companies who develop management standards for distributed desktop, network, enterprise, and Internet environments.

**domain** — A group of computers, programs, and devices on a network that are administered as a unit with common rules and procedures for use by a specific group of users. A user logs on to the domain to gain access to the resources.

**DRAM** — dynamic random-access memory — Memory that stores information in integrated circuits containing capacitors.

**driver** — Software that allows the operating system to control a device such as a printer. Many devices do not work properly if the correct driver is not installed in the computer.

**DSL** — Digital Subscriber Line — A technology that provides a constant, high-speed Internet connection through an analog telephone line.

**dual-core** — A technology in which two physical computational units exist inside a single processor package, thereby increasing computing efficiency and multi-tasking ability.

**dual display mode** — A display setting that allows you to use a second monitor as an extension of your display. Also referred to as *extended display mode*.

**DVD-R** — DVD recordable — A recordable version of a DVD. Data can be recorded only once onto a DVD-R. Once recorded, the data cannot be erased or written over.

**DVD+RW** — DVD rewritable — A rewritable version of a DVD. Data can be written to a DVD+RW disc, and then erased and written over (rewritten). (DVD+RW technology is different from DVD-RW technology.)

**DVD+RW drive** — drive that can read DVDs and most CD media and write to DVD+RW (rewritable DVDs) discs.

**DVI** — digital video interface — A standard for digital transmission between a computer and a digital video display.

## E

**ECC** — error checking and correction — A type of memory that includes special circuitry for testing the accuracy of data as it passes in and out of memory.

**ECP** — extended capabilities port — A parallel connector design that provides improved bidirectional data transmission. Similar to EPP, ECP uses direct memory access to transfer data and often improves performance.

**EMI** — electromagnetic interference — Electrical interference caused by electromagnetic radiation.

**ENERGY STAR®** — Environmental Protection Agency requirements that decrease the overall consumption of electricity.

**EPP** — enhanced parallel port — A parallel connector design that provides bidirectional data transmission.

**ESD** — electrostatic discharge — A rapid discharge of static electricity. ESD can damage integrated circuits found in computer and communications equipment.

**expansion card** — A circuit board that installs in an expansion slot on the system board in some computers, expanding the capabilities of the computer. Examples include video, modem, and sound cards.

**expansion slot** — A connector on the system board (in some computers) where you insert an expansion card, connecting it to the system bus.

**ExpressCard** — A removable I/O card adhering to the PCMCIA standard. Modems and network adapters are common types of ExpressCards. ExpressCards support both the PCI Express and USB 2.0 standard.

**Express Service Code** — A numeric code located on a sticker on your Dell™ computer. Use the Express Service Code when contacting Dell for assistance. Express Service Code service may not be available in some countries.

**extended display mode** — A display setting that allows you to use a second monitor as an extension of your display. Also referred to as *dual display mode*.

**extended PC Card** — A PC Card that extends beyond the edge of the PC Card slot when installed.

## F

**Fahrenheit** — A temperature measurement scale where 32° is the freezing point and 212° is the boiling point of water.

**FBD** — fully-buffered DIMM — A DIMM with DDR2 DRAM chips and an Advanced Memory Buffer (AMB) that speeds communication between the DDR2 SDRAM chips and the system.

**FCC** — Federal Communications Commission — A U.S. agency responsible for enforcing communications-related regulations that state how much radiation computers and other electronic equipment can emit.

**fingerprint reader** — A strip sensor that uses your unique fingerprint to authenticate your user identity to help secure your computer.

**folder** — A term used to describe space on a disk or drive where files are organized and grouped. Files in a folder can be viewed and ordered in various ways, such as alphabetically, by date, and by size.

**format** — The process that prepares a drive or disk for file storage. When a drive or disk is formatted, the existing information on it is lost.

**FSB** — front side bus — The data path and physical interface between the processor and RAM.

**FTP** — file transfer protocol — A standard Internet protocol used to exchange files between computers connected to the Internet.

## G

**G** — gravity — A measurement of weight and force.

**GB** — gigabyte — A measurement of data storage that equals 1024 MB (1,073,741,824 bytes). When used to refer to hard drive storage, the term is often rounded to 1,000,000,000 bytes.

**GHz** — gigahertz — A measurement of frequency that equals one thousand million Hz, or one thousand MHz. The speeds for computer processors, buses, and interfaces are often measured in GHz.

**graphics mode** — A video mode that can be defined as  $x$  horizontal pixels by  $y$  vertical pixels by  $z$  colors. Graphics modes can display an unlimited variety of shapes and fonts.

**GUI** — graphical user interface — Software that interacts with the user by means of menus, windows, and icons. Most programs that operate on the Windows operating systems are GUIs.



## H

**hard drive** — A drive that reads and writes data on a hard disk. The terms hard drive and hard disk are often used interchangeably.

**heat sink** — A metal plate on some processors that helps dissipate heat.

**hibernate mode** — A power management mode that saves everything in memory to a reserved space on the hard drive and then turns off the computer. When you restart the computer, the memory information that was saved to the hard drive is automatically restored.

**HTTP** — hypertext transfer protocol — A protocol for exchanging files between computers connected to the Internet.

**Hyper-Threading** — Hyper-Threading is an Intel technology that can enhance overall computer performance by allowing one physical processor to function as two logical processors, capable of performing certain tasks simultaneously.

**Hz** — hertz — A unit of frequency measurement that equals 1 cycle per second. Computers and electronic devices are often measured in kilohertz (kHz), megahertz (MHz), gigahertz (GHz), or terahertz (THz).

## I

**IC** — integrated circuit — A semiconductor wafer, or chip, on which thousands or millions of tiny electronic components are fabricated for use in computer, audio, and video equipment.

**IDE** — integrated device electronics — An interface for mass storage devices in which the controller is integrated into the hard drive or CD drive.

**IEEE 1394** — Institute of Electrical and Electronics Engineers, Inc. — A high-performance serial bus used to connect IEEE 1394-compatible devices, such as digital cameras and DVD players, to the computer.

**infrared sensor** — A port that allows you to transfer data between the computer and infrared-compatible devices without using a cable connection.

**integrated** — Usually refers to components that are physically located on the computer's system board. Also referred to as *built-in*.

**I/O** — input/output — An operation or device that enters and extracts data from your computer. Keyboards and printers are I/O devices.

**I/O address** — An address in RAM that is associated with a specific device (such as a serial connector, parallel connector, or expansion slot) and allows the processor to communicate with that device.

**IrDA** — Infrared Data Association — The organization that creates international standards for infrared communications.

**IRQ** — interrupt request — An electronic pathway assigned to a specific device so that the device can communicate with the processor. Each device connection must be assigned an IRQ. Although two devices can share the same IRQ assignment, you cannot operate both devices simultaneously.

**ISP** — Internet service provider — A company that allows you to access its host server to connect directly to the Internet, send and receive e-mail, and access websites. The ISP typically provides you with a software package, user name, and access phone numbers for a fee.

## K

**Kb** — kilobit — A unit of data that equals 1024 bits. A measurement of the capacity of memory integrated circuits.

**KB** — kilobyte — A unit of data that equals 1024 bytes but is often referred to as 1000 bytes.

**key combination** — A command requiring you to press multiple keys at the same time. **kHz** — kilohertz — A measurement of frequency that equals 1000 Hz.

## L

**LAN** — local area network — A computer network covering a small area. A LAN usually is confined to a building or a few nearby buildings. A LAN can be connected to another LAN over any distance through telephone lines and radio waves to form a wide area network (WAN).

**LCD** — liquid crystal display — The technology used by portable computer and flatpanel displays.

**LED** — light-emitting diode — An electronic component that emits light to indicate the status of the computer. **local bus** — A data bus that provides a fast throughput for devices to the processor.

**LPT** — line print terminal — The designation for a parallel connection to a printer or other parallel device.

## M

**Mb** — megabit — A measurement of memory chip capacity that equals 1024 Kb.

**Mbps** — megabits per second — One million bits per second. This measurement is typically used for transmission speeds for networks and modems.

**MB** — megabyte — A measurement of data storage that equals 1,048,576 bytes. 1 MB equals 1024 KB. When used to refer to hard drive storage, the term is often rounded to 1,000,000 bytes.

**MB/sec** — megabytes per second — One million bytes per second. This measurement is typically used for data transfer ratings.

**media bay** — A bay that supports devices such as optical drives, a second battery, or a Dell TravelLite™ module.

**memory** — A temporary data storage area inside your computer. Because the data in memory is not permanent, it is recommended that you frequently save your files while you are working on them, and always save your files before you shut down the computer. Your computer can contain several different forms of memory, such as RAM, ROM, and video memory. Frequently, the word memory is used as a synonym for RAM.

**memory address** — A specific location where data is temporarily stored in RAM.

**memory mapping** — The process by which the computer assigns memory addresses to physical locations at start-up. Devices and software can then identify information that the processor can access.

**memory module** — A small circuit board containing memory chips, which connects to the system board.

**MHz** — megahertz — A measure of frequency that equals 1 million cycles per second. The speeds for computer processors, buses, and interfaces are often measured in MHz.

**Mini PCI** — A standard for integrated peripheral devices with an emphasis on communications such as modems and NICs. A Mini PCI card is a small external card that is functionally equivalent to a standard PCI expansion card.

**Mini-Card** — A small card designed for integrated peripherals, such as communication NICs. The Mini-Card is functionally equivalent to a standard PCI expansion card.

**modem** — A device that allows your computer to communicate with other computers over analog telephone lines. Three types of modems include: external, PC Card, and internal. You typically use your modem to connect to the Internet and exchange email.

**module bay** — See *media bay*.

**MP** — megapixel — A measure of image resolution used for digital cameras.

**ms** — millisecond — A measure of time that equals one thousandth of a second. Access times of storage devices are often measured in ms.

## N

**network adapter** — A chip that provides network capabilities. A computer may include a network adapter on its system board, or it may contain a PC Card with an adapter on it. A network adapter is also referred to as a *NIC* (network interface controller).

**NIC** — See *network adapter*.

**notification area** — The section of the Windows taskbar that contains icons for providing quick access to programs and computer functions, such as the clock, volume control, and print status. Also referred to as *system tray*. **ns** — nanosecond — A measure of time that equals one billionth of a second.

**NVRAM** — nonvolatile random access memory — A type of memory that stores data when the computer is turned off or loses its external power source. NVRAM is used for maintaining computer configuration information such as date, time, and other system setup options that you can set.

## O

**optical drive** — A drive that uses optical technology to read or write data from CDs, DVDs, or DVD+RWs. Example of optical drives include CD drives, DVD drives, CDRW drives, and CD-RW/DVD combo drives.

## P

**parallel connector** — An I/O port often used to connect a parallel printer to your computer. Also referred to as an *LPT port*.

**partition** — A physical storage area on a hard drive that is assigned to one or more logical storage areas known as logical drives. Each partition can contain multiple logical drives.

**PC Card** — A removable I/O card adhering to the PCMCIA standard. Modems and network adapters are common types of PC Cards.

**PCI** — peripheral component interconnect — PCI is a local bus that supports 32- and 64-bit data paths, providing a high-speed data path between the processor and devices such as video, drives, and networks.

**PCI Express** — A modification to the PCI interface that boosts the data transfer rate between the processor and the devices attached to it. PCI Express can transfer data at speeds from 250 MB/sec to 4 GB/sec. If the PCI Express chip set and the device are capable of different speeds, they will operate at the slower speed.

**PCMCIA** — Personal Computer Memory Card International Association — The organization that establishes standards for PC Cards.

**PIO** — programmed input/output — A method of transferring data between two devices through the processor as part of the data path.

**pixel** — A single point on a display screen. Pixels are arranged in rows and columns to create an image. A video resolution, such as 800 x 600, is expressed as the number of pixels across by the number of pixels up and down.

**Plug-and-Play** — The ability of the computer to automatically configure devices. Plug and Play provides automatic installation, configuration, and compatibility with existing hardware if the BIOS, operating system, and all devices are Plug and Play compliant.

**POST** — power-on self-test — Diagnostics programs, loaded automatically by the BIOS, that perform basic tests on the major computer components, such as memory, hard drives, and video. If no problems are detected during POST, the computer continues the start-up.

**processor** — A computer chip that interprets and executes program instructions. Sometimes the processor is referred to as the CPU (central processing unit).

**PS/2** — personal system/2 — A type of connector for attaching a PS/2-compatible keyboard, mouse, or keypad.

**PXE** — pre-boot execution environment — A WfM (Wired for Management) standard that allows networked computers that do not have an operating system to be configured and started remotely.

## R

**RAID** — redundant array of independent disks — A method of providing data redundancy. Some common implementations of RAID include RAID 0, RAID 1, RAID 5, RAID 10, and RAID 50.

**RAM** — random-access memory — The primary temporary storage area for program instructions and data. Any information stored in RAM is lost when you shut down your computer.

**readme file** — A text file included with a software package or hardware product. Typically, readme files provide installation information and describe new product enhancements or corrections that have not yet been documented.

**read-only** — Data and/or files you can view but cannot edit or delete. A file can have read-only status if:

- It resides on a physically write-protected floppy disk, CD, or DVD.
- It is located on a network in a directory and the system administrator has assigned rights only to specific individuals.

**refresh rate** — The frequency, measured in Hz, at which your screen's horizontal lines are recharged (sometimes also referred to as its *vertical frequency*). The higher the refresh rate, the less video flicker can be seen by the human eye.

**resolution** — The sharpness and clarity of an image produced by a printer or displayed on a monitor. The higher the resolution, the sharper the image.

**RFI** — radio frequency interference — Interference that is generated at typical radio frequencies, in the range of 10 kHz to 100,000 MHz. Radio frequencies are at the lower end of the electromagnetic frequency spectrum and are more likely to have interference than the higher frequency radiations, such as infrared and light.

**ROM** — read-only memory — Memory that stores data and programs that cannot be deleted or written to by the computer. ROM, unlike RAM, retains its contents after you shut down your computer. Some programs essential to the operation of your computer reside in ROM.

**RPM** — revolutions per minute — The number of rotations that occur per minute. Hard drive speed is often measured in rpm.

**RTC** — real time clock — Battery-powered clock on the system board that keeps the date and time after you shut down the computer.

**RTCST** — real-time clock reset — A jumper on the system board of some computers that can often be used for troubleshooting problems.

## S

**SAS** — serial attached SCSI — A faster, serial version of the SCSI interface (as opposed to the original SCSI parallel architecture).

**SATA** — serial ATA — A faster, serial version of the ATA (IDE) interface.

**ScanDisk** — A Microsoft utility that checks files, folders, and the hard disk's surface for errors. ScanDisk often runs when you restart the computer after it has stopped responding.

**SCSI** — small computer system interface — A high-speed interface used to connect devices to a computer, such as hard drives, CD drives, printers, and scanners. The SCSI can connect many devices using a single controller. Each device is accessed by an individual identification number on the SCSI controller bus.

**SDRAM** — synchronous dynamic random-access memory — A type of DRAM that is synchronized with the optimal clock speed of the processor.

**serial connector** — An I/O port often used to connect devices such as a handheld digital device or digital camera to your computer.

**Service Tag** — A bar code label on your computer that identifies your computer when you access Dell Support at [support.dell.com](http://support.dell.com) or when you call Dell for customer service or technical support.

**setup program** — A program that is used to install and configure hardware and software. The **setup.exe** or **install.exe** program comes with most Windows software packages. *Setup program* differs from *system setup*.

**shortcut** — An icon that provides quick access to frequently used programs, files, folders, and drives. When you place a shortcut on your Windows desktop and doubleclick the icon, you can open its corresponding folder or file without having to find it first. Shortcut icons do not change the location of files. If you delete a shortcut, the original file is not affected. Also, you can rename a shortcut icon.

**SIM** — Subscriber Identity Module — A SIM card contains a microchip that encrypts voice and data transmissions. SIM cards can be used in phones or portable computers.

**smart card** — A card that is embedded with a processor and a memory chip. Smart cards can be used to authenticate a user on computers equipped for smart cards.

**S/PDIF** — Sony/Philips Digital Interface — An audio transfer file format that allows the transfer of audio from one file to another without converting it to and from an analog format, which could degrade the quality of the file.

**standby mode** — A power management mode that shuts down all unnecessary computer operations to save energy.

**Strike Zone™** — Reinforced area of the platform base that protects the hard drive by acting as a dampening device when a computer experiences resonating shock or is dropped (whether the computer is on or off).

**surge protectors** — Prevent voltage spikes, such as those that may occur during an electrical storm, from entering the computer through the electrical outlet. Surge protectors do not protect against lightning strikes or against brownouts, which occur when the voltage drops more than 20 percent below the normal AC-line voltage level.

Network connections cannot be protected by surge protectors. Always disconnect the network cable from the network connector during electrical storms.

**SVGA** — super-video graphics array — A video standard for video cards and controllers. Typical SVGA resolutions are 800 x 600 and 1024 x 768.

The number of colors and resolution that a program displays depends on the capabilities of the monitor, the video controller and its drivers, and the amount of video memory installed in the computer.

**S-video TV-out** — A connector used to attach a TV or digital audio device to the computer.

**SXGA** — super-extended graphics array — A video standard for video cards and controllers that supports resolutions up to 1280 x 1024.

**SXGA+** — super-extended graphics array plus — A video standard for video cards and controllers that supports resolutions up to 1400 x 1050.

**system board** — The main circuit board in your computer. Also known as the *motherboard*.

**system setup** — A utility that serves as an interface between the computer hardware and the operating system. System setup allows you to configure user-selectable options in the BIOS, such as date and time or system password. Unless you understand what effect the settings have on the computer, do not change the settings for this program.

## T

**TAPI** — telephony application programming interface — Enables Windows programs to operate with a wide variety of telephony devices, including voice, data, fax, and video.

**text editor** — A program used to create and edit files that contain only text; for example, Windows Notepad uses a text editor. Text editors do not usually provide word wrap or formatting functionality (the option to underline, change fonts, and so on).

**TPM** — trusted platform module — A hardware-based security feature that when combined with security software enhances network and computer security by enabling features such as file and e-mail protection.

**travel module** — A plastic device designed to fit inside the module bay of a portable computer to reduce the weight of the computer.

## U

**UAC** — user account control— Microsoft Windows Vista™ security feature that, when enabled, provides an added layer of security between user accounts and access to operating system settings.

**UMA** — unified memory allocation — System memory dynamically allocated to video.

**UPS** — uninterruptible power supply — A backup power source used when the electrical power fails or drops to an unacceptable voltage level. A UPS keeps a computer running for a limited amount of time when there is no electrical power. UPS systems typically provide surge suppression and may also provide voltage regulation. Small UPS systems provide battery power for a few minutes to enable you to shut down your computer.



**USB** — universal serial bus — A hardware interface for a low-speed device such as a USB-compatible keyboard, mouse, joystick, scanner, set of speakers, printer, broadband devices (DSL and cable modems), imaging devices, or storage devices. Devices are plugged directly in to a 4-pin socket on your computer or in to a multi-port hub that plugs in to your computer. USB devices can be connected and disconnected while the computer is turned on, and they can also be daisy-chained together.

**UTP** — unshielded twisted pair — Describes a type of cable used in most telephone networks and some computer networks. Pairs of unshielded wires are twisted to protect against electromagnetic interference, rather than relying on a metal sheath around each pair of wires to protect against interference.

**UXGA** — ultra extended graphics array — A video standard for video cards and controllers that supports resolutions up to 1600 x 1200.

## V

**video controller** — The circuitry on a video card or on the system board (in computers with an integrated video controller) that provides the video capabilities—in combination with the monitor—for your computer.

**video memory** — Memory that consists of memory chips dedicated to video functions. Video memory is usually faster than system memory. The amount of video memory installed primarily influences the number of colors that a program can display.

**video mode** — A mode that describes how text and graphics are displayed on a monitor. Graphics-based software, such as Windows operating systems, displays in video modes that can be defined as  $x$  horizontal pixels by  $y$  vertical pixels by  $z$  colors. Character-based software, such as text editors, displays in video modes that can be defined as  $x$  columns by  $y$  rows of characters. **video resolution** — See *resolution*.

**virus** — A program that is designed to inconvenience you or to destroy data stored on your computer. A virus program moves from one computer to another through an infected disk, software downloaded from the Internet, or e-mail attachments. When an infected program starts, its embedded virus also starts.

A common type of virus is a boot virus, which is stored in the boot sectors of a floppy disk. If the floppy disk is left in the drive when the computer is shut down and then turned on, the computer is infected when it reads the boot sectors of the floppy disk expecting to find the operating system. If the computer is infected, the boot virus may replicate itself onto all the floppy disks that are read or written in that computer until the virus is eradicated.

**V** — volt — The measurement of electric potential or electromotive force. One V appears across a resistance of 1 ohm when a current of 1 ampere flows through that resistance.

## W

**W** — watt — The measurement of electrical power. One W is 1 ampere of current flowing at 1 volt.

**WWhr** — watt-hour — A unit of measure commonly used to indicate the approximate capacity of a battery. For example, a 66-WWhr battery can supply 66 W of power for 1 hour or 33 W for 2 hours.

**wallpaper** — The background pattern or picture on the Windows desktop. Change your wallpaper through the Windows Control Panel. You can also scan in your favorite picture and make it wallpaper.

**WLAN** — wireless local area network. A series of interconnected computers that communicate with each other over the air waves using access points or wireless routers to provide Internet access.

**write-protected** — Files or media that cannot be changed. Use write-protection when you want to protect data from being changed or destroyed. To write-protect a 3.5-inch floppy disk, slide its write-protect tab to the open position.

**WWAN** — wireless wide area network. A wireless high-speed data network using cellular technology and covering a much larger geographic area than WLAN.

**WXGA** — wide-aspect extended graphics array — A video standard for video cards and controllers that supports resolutions up to 1280 x 800.

## X

**XGA** — extended graphics array — A video standard for video cards and controllers that supports resolutions up to 1024 x 768.

## Z

**ZIF** — zero insertion force — A type of socket or connector that allows a computer chip to be installed or removed with no stress applied to either the chip or its socket.

**Zip** — A popular data compression format. Files that have been compressed with the Zip format are called Zip files and usually have a filename extension of **.zip**. A special

kind of zipped file is a self-extracting file, which has a filename extension of **.exe**. You can unzip a self-extracting file by double-clicking it.

**Zip drive** — A high-capacity floppy drive developed by Iomega Corporation that uses 3.5-inch removable disks called Zip disks. Zip disks are slightly larger than regular floppy disks, about twice as thick, and hold up to 100 MB of data.